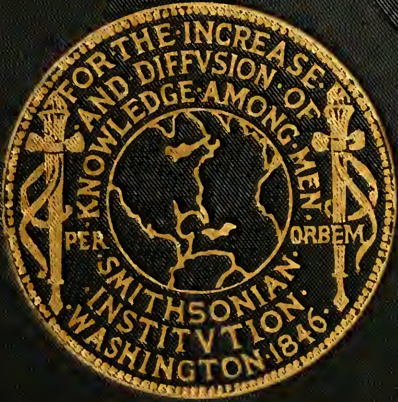
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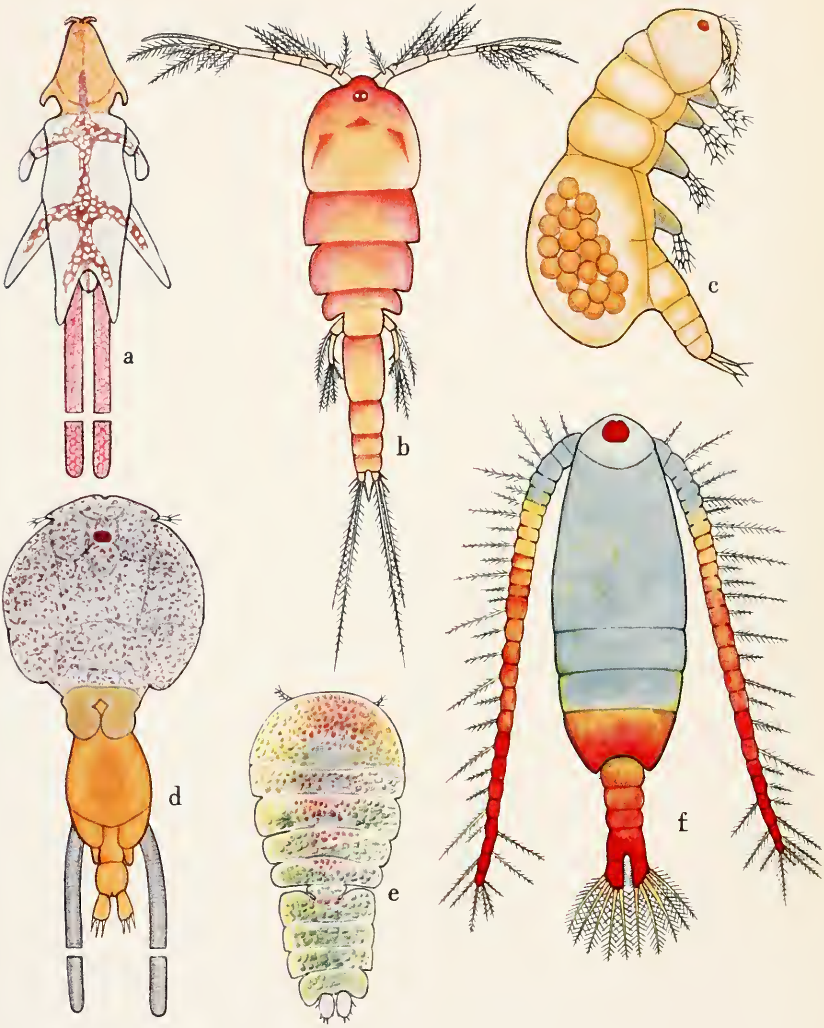

Some Woods Hole Copepods in Color

For description see explanation of plates

SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM
BULLETIN 158

THE COPEPODS OF THE WOODS HOLE REGION MASSACHUSETTS

BY
CHARLES BRANCH WILSON
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Westfield, Mass.

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A Tribute to the Memory of

Richard Rathbun

Assistant Secretary of the Smithsonian Institution
February 1, 1897, to July 16, 1918

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The present work forms No. 158 of the *Bulletin* series.

Alexander Wetmore,
Assistant Secretary, Smithsonian Institution.

Washington, D. C., *August 16, 1932.*

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BULLETIN 158, UNITED STATES NATIONAL MUSEUM

ERRATUM

The running heads of the even-numbered pages from 540 to 622 have been incorrectly worded " Bulletin 159, United States National Museum "; these should read " Bulletin 158, United States National Museum."

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20. *Rathbunula curticauda*, new species: *a*, Female, dorsal; *b*, male, dorsal; *c*, female, first antenna; *d*, second antenna; *e*, *f*, *g*, *h*, first, second, fourth, and fifth legs; *i*, male, fifth leg.
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26. *Alebion crassus*, new species; *a*, Female, dorsal; *b*, male, dorsal; *c*, maxilliped; *d*, first leg; *e*, second leg.
27. *Echthrogaleus coleoptratus:* *a*, Female, dorsal; *b*, second antenna; *c*, maxilliped; *d*, male dorsal; *e*, second antenna; *f*, maxilliped.
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29. *Krøyeria gracilis*, new species; *a*, Female, dorsal; *b*, male, dorsal; *c*, first antenna; *d*, second antenna; *e*, second maxilla; *f*, maxilliped; *g*, female, first leg; *h*, male, fourth leg.
30. *Krøyeria papillipes: a*, Female, dorsal; *b*, male dorsal; *c*, first antenna; *d*, second antenna; *e*, maxilliped; *f*, female, first leg; *g*, papillae on middle endopod segment; *h*, fourth leg; *i*, papillae on middle endopod segment.
    Krøyeria lineata: j, Female, dorsal; *k*, second antenna; *l*, maxilliped; *m*, first leg.
31. *Krøyerina nasuta*, new genus, new species: *a*, Female, dorsal; *b*, male, dorsal; *c*, first antenna; *d*, second antenna; *e*, second maxilla; *f*, maxilliped; *g*, *h*, *i*, *j*, first, second, third, and fourth legs; *k*, egg string.
    Krøyerina elongata, new species: *l*, Female, dorsal; *m*, first antenna; *n*, second antenna; *o*, maxilliped; *p*, first leg.
32. *Nemesis lamna: a*, Female, dorsal; *b*, male, dorsal; *c*, female, second antenna; *d*, second maxilla; *e*, maxilliped; *f*, *g*, *h*, *i*, first, second, third, and fourth legs; *j*, *k*, *l*, male, first, third, and fourth legs; *m*, male, ventral plate on genital segment.
33. *Nemesis atlantica: a*, Female, dorsal.
    Nemesis pallida: b, Female, dorsal; *c*, male, dorsal; *d*, first antenna; *e*, second antenna; *f*, second maxilla; *g*, *h*, *i*, *j*, *k*, first, second, third, fourth, and fifth legs; *l*, second antenna of male; *m*, second maxilla; *n*, maxilliped; *o*, fifth leg; *p*, male, side view of genital segment, showing ventral plate.
34. *Eudactylina spinifera*, new species: *a*, Female, dorsal; *b*, first antenna; *c*, second antenna; *d*, second maxilla; *e*, maxilliped; *f*, *g*, *h*, *i*, first, second, third, and fourth legs.
35. *Eudactylinodes uncinata*, new genus, new species: *a*, Female, dorsal; *b*, male, dorsal; *c*, female, first antenna; *d*, first leg; *e*, fifth leg; *f*, male, first antenna; *g*, second antenna; *h*, second maxilla; *i*, maxilliped; *j*, *k*, *l*, *m*, first, second, third, and fourth legs.
    Eudactylinodes nigra: *n*, Female, dorsal.
36. *Eudactylinella alba*, new genus, new species: *a*, Female, dorsal; *b*, female, lateral; *c*, male, dorsal; *d*, female, first antenna; *e*, second antenna; *g*, second maxilla; *h*, maxilliped; *i*, *j*, *k*, *l*, first, second, third, and fourth legs.
37. *Acanthochondria exilipes*, new species: *a*, Female, dorsal; *b*, male, lateral; *c*, female, first antenna; *d*, first leg, *e*, second leg.
    Acanthochondria flurae: f, Female, dorsal; *g*, male lateral; *h*, female, first antenna; *i*, mandible; *j*, maxilla; *k*, male, second antenna; *l*, second maxilla; *m*, maxilliped; *n*, first leg.
38. *Chondracanthodes deflexus*, new genus, new species; *a*, Female, dorsal; *b*, female, lateral; *c*, male, lateral; *d*, female, second antenna; *e*, mandible; *f*, maxilla; *g*, maxilliped; *h*, male, first antenna; *i*, second antenna; *j*, maxilla; *k*, *l*, female, first and second legs; *m*, *n*, male, first and second legs.
39. *Chondracanthopsis nodosus*, new genus; *a*, Female, dorsal; *b*, male, lateral; *c*, female, second antenna; *d*, maxilla; *e*, maxilliped; *f*, first leg; *g*, second leg.
40. *Paeon elongatus*, new species; *a*, Female, head ventral, trunk dorsal; *b*, male, lateral; *c*, female, head, ventral view enlarged; *d*, second antenna; *e*, maxilliped; *f*, male, second antenna; *g*, first maxilla; *h*, second maxilla; *i*, maxillipeds.
41. *Paeon elongatus*, development stages: *a*, Newly hatched metanauplius, ventral; *b*, copepodid stage, dorsal; *c*, first antenna; *d*, second antenna; *e*, mouth parts, ventral; *f*, second maxilla; *g*, maxilliped; *h*. first leg; *i*, second leg.

THE COPEPODS OF THE WOODS HOLE REGION MASSACHUSETTS

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INTRODUCTION

LIMITS OF THE AREA STUDIED

The Woods Hole region as considered in this report includes the whole of Cape Cod, Mass., and all the islands south of it and those portions of the surrounding ocean between latitude 40° and 42° N. and between longitude 69° and 72° W. The area is thus approximately 200 miles wide and 150 miles long, and its limits have been determined by the sources of the material upon which this bulletin is based. Any reduction of the area would of necessity eliminate some of the excellent material gathered during the earliest cruises of the *Fish Hawk* and the *Albatross*. As these were all included in the notes and drawings made by Dr. Richard Rathbun, it has been deemed best to keep the collection intact.

COPEPODS INCLUDED

This report comprises a study of marine, brackish-water, and fresh-water copepods—free-swimming, commensal, semiparasitic, and parasitic species. The region lies just at the latitude where the northern and southern faunas meet and overlap. It contains, therefore, copepod representatives of three distinct plankton faunas. The first of these are the intrinsic species of the area itself, especially of the ponds and the beach sands, and they constitute the great majority of the present list. Then there are northern species, which have been brought down by various currents from the Bay of Fundy, the Gulf of St. Lawrence, or even farther north, and these make up the list of northern stragglers. Finally there are southern species, brought up fom the tropical Atlantic by the Gulf Stream, which may properly be regarded as tropical visitors.

LISTS PREVIOUSLY PUBLISHED

The first list of copepods from the Woods Hole region was made by Dr. W. M. Wheeler and was published in the Bulletin of the United States Bureau of Fisheries for 1899, which appeared on August 30, 1900. It contained 30 species and was entirely confined to free-swimming marine forms.

The second list appeared as two papers by Dr. L. W. Williams upon the copepods of the Narragansett region of Rhode Island. The first paper was published in the American Naturalist (vol. 40, 1906) and included 28 species, 26 of which were free swimming, the other two parasitic.

The second Williams paper appeared in the Thirty-seventh Annual Report of the Commissioners of Inland Fisheries of Rhode Island, 1907, and contained 43 species of copepods. Of these, 8 were parasitic, 3 were fresh-water species of the genus *Cyclops*, and the rest were free-swimming marine forms.

The third list was published by Dr. R. W. Sharpe in the Proceedings of the United States National Museum (vol. 38, 1910). It included all the species in the preceding lists and enough others to bring the total up to 59.[1]

Dr. C. J. Fish published a fourth list in 1925 in volume 41 of the Bulletin of the Bureau of Fisheries. His observations were practically confined to Great Harbor, Woods Hole, and his list contained 42 species, 12 of which had not been previously reported. These were all free-swimming marine forms with the exception of a single parasitic species. If the 12 new forms be added to Sharpe's list of 59 they bring the total up to 71.

In addition to these regular lists there have been published various papers by the present author on North American parasitic copepods, including a number of parasitic species collected at or near Woods Hole. These are found to represent in all 77 species, and if they be added to the above total of 71 they bring the number of copepods of all kinds, thus far reported from the region now under discussion, up to 148. In the present paper the number has been increased to 373 species divided into 178 genera.

SOURCE OF THE PRESENT MATERIAL

During the summers and early in the autumns of the years from 1881 to 1885, inclusive, Dr. Richard Rathbun, late assistant secretary of the Smithsonian Institution, made an extensive collection of copepods in the region around Woods Hole. A portion of his specimens were obtained by surface towing, and the remainder were taken during the trawling and dredging operations carried on by the two steamers, the *Fish Hawk* and the *Albatross*, newly purchased at that time by the Bureau of Fisheries. This collection made by Doctor Rathbun forms the basis of the present paper and has been supplemented from various sources. The Bureau of Fisheries' station at Woods Hole has contributed its entire collection of local copepods gathered since 1885. Most of the vials in this collection are labeled in the handwritings of Vinal Edwards and Robert Goffin, and they have added many interesting species that would have otherwise remained undiscovered. The investigation of the various freshwater, brackish, and salt-water ponds was begun by Doctor Rathbun, but has been conducted chiefly by the present author. Here again whatever success has been achieved has been due in large measure to the facilities afforded by the Bureau of Fisheries. There should also be mentioned the investigation of the beach sands, which is discussed elsewhere (p. 6) and which added many new and interesting copepods to the fauna of the region.

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[1] By some curious mistake Sharpe included a species, *Bradya limicola,* reported by Herrick from the coast of the Gulf of Mexico.

EXCEPTIONAL FEATURES OF THE MATERIAL

The material thus accumulated possesses certain exceptional features. In the first place Doctor Rathbun examined his specimens carefully and made extensive notes upon each of them while they were still alive. He paid especial attention to their living coloration, and the word pictures he drew of their wonderful combinations of color are fully as vivid and realistic as the painted reproductions in Giesbrecht's famous monograph on the fauna and flora of the Gulf of Naples. These color notes were turned over to the present author with the specimens and are here published as nearly verbatim as has been possible. They give us accurate information about the appearance of many of our common American species, which are otherwise known only by some structural characteristic. Such color descriptions are especially timely in view of the fact that the great majority of investigators who have worked with copepods have seen only preserved material, which gave them no idea of the natural colors. Even such an exhaustive work as that recently published by Sars upon the Crustacea of Norway is obliged to record repeatedly " Color not yet ascertained," after a detailed structural description.

The second remarkable feature of the present collection is the large number of species that have never before been reported from this Woods Hole region. Indeed, for many of them this constitutes the first record of the species anywhere along the Atlantic shores of North America. This question naturally arises: How does it happen that so many species escaped the attention of those investigators who published the lists already mentioned? The first answer is suggested by a perusal of the notes and records made by Doctor Rathbun and his associates. They were exceptionally thorough in their search, and their task was accomplished long before the introduction of any agitation in reference to an 8-hour working-day. Several of the hauls with both the trawl and the townet are recorded as having been made as early as at 4.30 o'clock in the morning, while others came as late as 9.30 in the evening on the same day. Evidently in the interests of science a 17-hour day was not deemed impossible by those enthusiasts. Casual hauls made during the ordinary working hours might well fail to include certain species that could be obtained early in the morning or late in the evening.

A second and far more potent answer to the question is to be found in the use of a device designated as "trawl wings." Many of the species in the present list that are new to the Woods Hole region were captured in the trawl wings. It becomes, therefore, of scientific interest to know what this device was and how it was used. Doctor Rathbun has clearly explained this in a manuscript entitled "Manual of Collecting," which was compiled shortly after the copepods were collected but was never published. It still remains in the possession of the United States National Museum, and from it the following is quoted:

> *Trawl wings.*—It is now customary in the dredging work of the Fish Commission to use two winglike attachments to the beam trawl. These trawl wings, as they are called, consist of a bag-shaped and rather coarse net, attached to a rectangular iron frame, suspended from a bar on each side of the trawl, and in which, when in use, a fine towing net is inserted. The object of the trawl wings is to afford a means of capturing the small free-swimming animals, which often live in extreme abundance just above the bottom, and which, when taken in the trawl net proper, are washed through the coarse meshes, or lost sight of in the heterogeneous mass of large specimens mingled with the bottom mud and sand. The quantity of fine material brought up by the wings is frequently surprising, especially to one who has never seen them used before, and the slight additional expense of supplying them will certainly be repaid to the collector many times over.
>
> As an instance of their value the writer will say that he has rarely seen a specimen of free-swimming copepod brought up from deep water in either the dredge or beam trawl proper, while from a single haul of the trawl wings in depths of 100 to 1,000 fathoms, it has been no uncommon occurrence to obtain from one-fourth to one-half a pint of clear copepods mingled with other forms of small crustaceans, both adult and larval stages, small annelids, free-swimming mollusks, etc. After having carefully examined the contents of several hundred hauls of the beam trawl with wing attachments during three or four years, the writer can safely assert that the material brought up in the wings is almost entirely additional to that obtained from the trawl net, and furthermore the contents of the wings reach the surface in far better condition than the large specimens in the trawl net. In fact, they seldom appear to have received any harder usage than the contents of a towing net skimming the surface behind a sailboat or a rowboat. The trawl wings have already added

several hundred species of small animals to the deep-water fauna off the New England coast, and their use is strongly recommended to all deep-sea explorers. It can never be known just how much of the material taken in the trawl wings comes from the bottom, as many specimens are undoubtedly captured by them on their passage from the bottom to the surface. It seems fair to presume, however, that the greater part of what they contain was actually taken at the bottom, as many repeated experiments with the towing net attached to the dredge rope at numerous intermediate depths have always failed to discover anything like the same abundance of life.

The trawl wings were first suggested by Capt. H. C. Chester, of the Fish Commission in 1880, and under his supervision the first pair was constructed and put to use in that year on the steamer *Fish Hawk*. The trawl wings have seldom been known to foul in the descent and very rarely take in any of the bottom sand or mud. The contents consist almost invariably of nothing but small forms of animal life, which after they have been transferred to a bucket or dish of clear water may be examined like surface towings.

In addition to recording color notes, Doctor Rathbun dissected and mounted the appendages of many species, and there are 150 of his microscope slides in as good condition as when they were first made. These have been of great assistance in determining species, especially in a few instances where only a single preserved specimen was left. Accurate drawings were also made from these slides and from the entire copepods. The present author has already published a long list of these drawings in connection with the parasitic species. There are here added those belonging to the free-swimming forms, not quite so numerous, but many of them possessing exceptional value.

If all this wealth of material be considered in connection with the several papers that Doctor Rathbun published, it can easily be seen that he would have become one of the foremost authorities upon copepods, had not his executive duties compelled him to give up research work. It is, therefore, eminently appropriate that the present paper, which embodies so much of his work, be dedicated to his memory.

PONDS OF THE AREA

Another good reason for the increase in the number of species recorded in the present list may be found in the fact that here for the first time an effort has been made to examine the plankton of the ponds as well as that of the ocean. If one consults a good map of this region, for example the contour maps of the United States Geological Survey, one of the first impressions received is that of the remarkable abundance of small ponds. Beginning at Woods Hole itself and continuing along the southern shore of the cape to Chatham and then north to Provincetown, there is an almost continuous succession of ponds of every description. Large ponds and small ponds with those of moderate size; ponds filled with fresh water, with brackish water, and with salt water; ponds whose entire areas possess the same salinity and mineral contents; ponds into whose inland ends run streams of fresh water large enough to be called rivers, while the other ends open directly into the ocean; ponds virtually large tide pools, into which the tide flows and ebbs twice a day, and during a longer or shorter interval remains at the same level; ponds filled with fresh water the greater portion of the year, but into which the neap tides pour salt water every spring and fall; ponds whose bottoms are composed of mud so soft that it is impossible to wade in them; ponds with bottoms of hard sand and gravel; and ponds whose bottoms are continuous ledges of solid rock.

The same variety of ponds is found around the shores of Marthas Vineyard, Chappaquiddick Island, and Nantucket. The largest of these ponds on Marthas Vineyard is called Edgartown Great Pond. From its inland end is pumped Edgartown's supply of drinking water, while the outer end periodically opens into the Atlantic.

Away from the shores of Cape Cod and the islands is another series of ponds, all of which are filled with strictly fresh water. These are of glacial origin and show a similar variation in size, in the quantity of vegetation they contain, and in the kind of bottom.

Under such diverse conditions it would naturally be expected that the plankton would vary greatly, and such we find to be the case. The faunas of these ponds are almost entirely made up of species unlike those of the neighboring ocean, and no two of the lists are alike. As a result these ponds have contributed a very large number of species new to the region and several species new to science. (See Appendix A, p. 534, for list and description of the ponds of the area.)

SAND BEACHES OF THE AREA

At first the idea of sand as a habitat for copepods seems absurd, but from the very beginning of plankton investigation it has been known that many copepods persistently remain on or near the bottom. Other species are known to inhabit marine algae, and still others habitually live on fresh-water mosses and aquatic plants. Recently it has been discovered that a few forms live in the damp moss of deep forests, away from any actual body of water.

It may now be added that a great variety of copepods select for their habitat the sands of the bathing beaches, offshore banks, and fresh-water lakes and ponds. Even those exposed shores where the surf pounds the hardest and the most continuously yield a surprising copepod fauna. If the sand from such localities, where it is covered by water, be scraped up to a depth of 2 or 3 inches and thoroughly washed, the wash water will be found to contain a remarkable number and variety of copepods. This is true between tide marks as well as just beyond low-water mark when the tide is out; of course, it holds good continuously with reference to the sand obtained from offshore banks and during dredging operations.

The sand can be washed conveniently in two long-handled dippers; with one dipper enough sand is scraped from the bottom to fill it one-quarter full, the other three-quarters being filled with water. The water is then poured back and forth between the two dippers, thoroughly roiling the sand. The sand grains sink quickly to the bottom each time, while the copepods are forced out by the currents and remain in the water above the sand. Finally, with a pause long enough to allow the sand to settle, the wash water is poured into a pail or other convenient receptacle. When a sufficient quantity has been thus obtained it can be strained through an ordinary townet.

By this means it has been ascertained that the sand has a rich and varied fauna of its own, even more sharply distinguished from the pelagic and littoral faunas than they are from each other. Of course, a few littoral species get in the wash water, but the number is surprisingly small and nearly always they can be recognized by their size alone, the sand copepods being usually less than half a millimeter in length. Furthermore these sand dwellers are thus far all harpactids with the exception of the genus *Cyclopina*, one of the Cyclopoida. Many of the harpactids described by Scott and Sars are probably true sand dwellers, although they could not be definitely recognized as such owing to the manner in which they were captured. Sars, in his Crustacea of Norway (vol. 5, p. 398), mentioned " many interesting copepods obtained from an off-shore bank with a coarse sandy bottom at a depth of 30 to 40 fathoms." As this is the typical form of the sand dwellers, and as all his species were considerably less than a millimeter in length, it is probable that some of them at least habitually lived in the sand. In his account of the copepods of the Scottish Antarctic expedition,[2] T. Scott mentioned 15 or 20 species of harpactids as " obtained from siftings of dredged material " near the South Orkney Islands. Thompson and A. Scott, in enumerating the copepods collected at Ceylon,[3] reported many of the harpactids as " found in pearl oyster washings " and " in the general washings of invertebrates." Some if not most of these must have been sand-dwelling copepods.

As a sample of what may be obtained from washing the sand it may be said that a single 10-quart pailful of wash water from the sand of the shore of Katama Bay, Marthas Vineyard, yielded 800 of these sand dwellers, distributed among 25 different species. Only 3 of the species and less than 50 of the specimens could be classed as littoral forms; the others may be designated as benthonic.

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[2] Trans. Roy. Soc. Edinburgh, vol. 48, pp. 521–599, 1912.

[3] Report on the pearl-oyster fisheries of Ceylon, Suppl. Rep. No. 7, pp. 227–307, 1903.

SCOPE AND LIMITATIONS OF THE SURVEY

This report endeavors to present a convenient handbook of the copepod life of the region that will enable one to identify such species as he may find. For this purpose the descriptions are limited chiefly to distinguishing characters and contain the minimum of technical nomenclature consistent with scientific accuracy. Keys are included as an aid in identification; the keys to the genera include practically every valid genus thus far described; the keys to the species include only those found in the region.

The author realizes only too well that the present survey is far from complete and that there must be many species and genera yet awaiting discovery. It is also very evident that in an undertaking like the one here attempted there are many chances of error. It can not be expected that all these have been successfully avoided, but it is hoped that a workable basis has been laid for future study.

Order COPEPODA

General characters.—The copepods constitute the largest division of the Crustacea and include free-swimming, benthonic, commensal, semiparasitic, and parasitic forms. They are small in size, often less than half a millimeter in length and very rarely exceeding 10 mm. The body is more or less distinctly segmented, except in a few parasitic genera, and is destitute of a true shell gland. Instead, the cephalon or cephalothorax is often covered with a carapace, and one or more of the thoracic segments may develop paired dorsal plates. The last segment of the abdomen bears a pair of laminae, which may be called anal laminae or caudal rami. The genital apertures are on the last thoracic segment, which for this reason is called the genital segment. The two pairs of antennae are well developed and are often used for locomotion or for prehension, the latter use being especially common in parasitic forms. The mandibles usually have a palp, which is often biramose. Fertilization is accomplished by spermatophores, and the eggs are carried, with few exceptions, in external cases attached to the genital segment. There are neither spermatophores nor egg cases in the suborder Arguloida, and in the Notodelphyoida the egg cases are replaced by an incubatory pouch on the dorsal surface of the thorax. The swimming legs are confined to the thorax, and the abdomen carries no appendages except the caudal rami.

Morphological nomenclature.—The body of a copepod is made up of three regions—head, thorax, and abdomen. When one or more of the anterior thoracic segments are fused with the head, the first region is called the cephalothorax. The head is regarded as a single segment, the thorax contains six segments, and the abdomen from one to five segments. Some authors regard the genital segment as part of the abdomen, and a few call everything behind the movable articulation the abdomen, even though it may include the fifth thoracic segment. It is perfectly evident, however, that the same segment can not be a part of the abdomen in one copepod and a part of the thorax in another. For this reason it is much better to adopt the nomenclature of Sars, and call that part of the body in front of the movable articulation the metasome and the part behind the articulation the urosome. The latter always includes the genital segment with the abdomen and may or may not include also the fifth segment. In free-swimming forms the fifth thoracic segment is nearly always separated from the sixth, and the fifth legs that it bears are the most distinctive character of the species. In semiparasitic and commensal copepods the fifth segment is sometimes free and sometimes fused with the sixth. When free the fifth legs still furnish a very important specific character; when fused they possess little if any specific value. In the parasitic copepods the fifth segment is usually fused with the sixth, and the fifth legs are very often lacking. Even when present they possess practically no systematic value.

There are six pairs of appendages on the head, two pairs of antennae, one pair of mandibles, two pairs of maxillae, and one pair of maxillipeds. All modern investigators agree in the names of the first three pairs, but in dealing with the last three pairs there are still some eminent writers who continue to regard them as one pair of maxillae and two pairs of maxillipeds. This mode of naming them originated with Claus, who claimed that the last two pairs of these appendages began development as the endopod and exopod of a single pair, and afterwards became separated. But in one of the last papers published by Claus, entitled "Ueber die Maxillarfüsse der Copepoden,"[4] he proved conclusively that he had been mistaken in this claim, acknowledged his error, and changed the names of the appendages to agree with his new discovery, calling them now two pairs of maxillae and one pair of maxillipeds. Giesbrecht and Hansen had already interpreted them in this manner as a result of their studies upon the development of the free-swimming copepods. The present author established the same nomenclature for the parasitic forms in 1910, although previous to that time he was an advocate of Claus's original claim and unacquainted with his subsequent correction. There is no excuse whatever for continuing the error, and every reason for adopting the new nomenclature, which accordingly is used in this bulletin.

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[4] Arb. Zool. Inst. Wien, vol. 11, pt. 1, pp. 49–63, 1895.

Each of the thoracic segments may bear a pair of legs, those on the fifth and sixth segments being more or less modified and rudimentary. In the free-swimming copepods the sixth pair is nearly always lacking, and often also the fifth pair in the females, but both pairs are often present in parasitic and semiparasitic forms, and in the males of the free swimmers.

At the posterior end of the abdomen there is a pair of appendages, which are usually well armed with setae. In the free-swimming copepods it has been customary to call them the furca, and each of them a furcal ramus. But the name furca was applied more than 100 years ago to an organ on the ventral surface of *Caligus* and allied genera of the Caligoida. This is not an appendage in the same sense as the other organs already enumerated, but is unpaired on the midline and aids in prehension. Accordingly in this report the designation used by Sars will be adopted and this pair of abdominal appendages called caudal rami.

Classification adopted.—The classification here adopted was first suggested 20 years ago by G. O. Sars. It is much the simplest one ever offered and is the only one that furnishes a place for every valid genus. Why not extend it to include the argulids as well as the other copepods, and eliminate the usual division into Eucopepoda and Branchiura? The latter suborder contains only the argulids, and hence nothing is really gained by introducing a second name for them. Moreover this second name, Branchiura, is a rank misnomer because it perpetuates the mistaken idea that in the argulids respiration is confined to the tail, while in the Eucopepoda it takes place elsewhere in the body. In reality the exact reverse of this comes nearer to the truth; the argulids have comparatively little tail respiration, the true respiratory areas being situated in the cephalothorax. On the contrary in the Eucopepoda the most important respiration takes place in the rectum, and there are no respiratory areas in other parts of the body. This division of the copepods therefore was false in its original conception, and has been steadily growing more inaccurate, as our knowledge of the Crustacea has progressed; is it not about time to discard it? If this be done the order Copepoda may be divided directly into the following eight suborders: Arguloida, Calanoida, Harpacticoida, Cyclopoida, Notodelphyoida, Monstrilloida, Caligoida, and Lernaeopodoida.

Copepod families.—With reference to the gathering of the genera into families we find everywhere the greatest diversity of opinion. Giesbrecht and Schmeil in Das Tierreich discussed all the genera of the Calanoida that had been described up to that time (1898). They divided the 65 genera that they considered valid into five families. A little later (1901) Sars in his work on the Crustacea of Norway began to present the Calanoida. When he finally completed the group by a supplement issued in 1919, he had included 43 genera and had divided them into 24 families. In comparison with Giesbrecht and Schmeil, two-thirds as many genera were divided into five times as many families. The differences in the family grouping proposed by any other two authors might not be so great as this, but no two systematic papers have thus far appeared in which there was any agreement as to the numbers or limitations of the families. Every author, however, is practically agreed as to which of the eight suborders any given genus ought to belong. For the present therefore it would seem to be wise to emphasize this primary division into eight suborders and to place much less stress upon the secondary division into families. Especially would it be unwise to attempt any serious change in the family limitations or to introduce any new arrangement of the family groups. The family names here used are suggestive of what seems most rational in the recent systematic discussions of the copepods, without any attempt to fix their exact limitations.

Suborder ARGULOIDA

Fourth or last pedigerous segment firmly attached to the third but forming a movable articulation with the fifth segment. Head fused with the first segment and covered with a carapace, which is expanded on each side into a broad lobe. Second, third, and fourth segments free, each together with the first segment bearing a pair of biramose swimming legs; fifth and sixth segments fused with the abdomen without any trace of segmentation or swimming legs. This fused urosome is notched or bilobed posteriorly and bears a pair of caudal rami. The head bears two large compound eyes, which are movable and surrounded by a blood sinus. Each lateral lobe of the carapace contains two respiratory areas, sometimes fused, sometimes separate, whose arrangement and shape are peculiar in each species and thus afford a good specific character. First antennae transformed for prehension and armed with curved claws; second antennae uniramose; second maxillae also transformed into prehensile sucking disks, except in the genus *Dolops*. A well-defined heart with a short aorta and a definite blood circulation. Fertilization not accomplished by spermatophores, and eggs not carried in external ovisacs but fastened in rows to foreign objects.

Remarks.—The genus *Argulus* is the only one of the Arguloida found in North America; it is entirely parasitic, usually upon fish, and may be obtained in fresh, brackish, or salt water. As yet no fresh-water species has been discovered within the present area, but this is chiefly due to lack of search, and such a form is likely to appear at any time.

Family ARGULIDAE

Genus ARGULUS Müller, 1785

Carapace strongly flattened and shield-shaped, its lateral lobes varying much in length; urosome differing greatly in size and shape but always bilobed posteriorly and furnished with a pair of caudal rami. Basal portion of first antennae flattened and armed with an anterior and a lateral claw; terminal portion cylindrical, 2 or 3 segmented. A sheathed sting in front of the mouth, used as a piercing organ; second maxillae transformed into sucking disks, whose margins are supported by a series of chitin rods. Maxillipeds with a chitin plate on the ventral surface of the basal segment, the posterior margin of the plate produced into spines, teeth, or lobes. Basal segments of the fourth legs usually produced into boot-shaped lobes beneath the abdomen. Anterior legs with or without flagella; basal segments of the posterior pairs in the male sexually modified. Ovary of the female in the posterior portion of the metasome, testes of the male in the urosome.

KEY TO THE SPECIES (BOTH SEXES)

1. Carapace orbicular, as wide as long or definitely wider ---- 2
Carapace elliptical or oval, definitely longer than wide ---- 4
2. Posterior margin of basal plate of maxillipeds produced into 3 stout teeth; carapace lobes very short ---- **funduli** (p. 13)
Posterior margin of basal plate of maxillipeds without teeth; carapace lobes relatively longer, sometimes reaching the urosome ---- 3
3. Urosome definitely longer than wide, its posterior lobes sharply pointed; anterior legs without flagella ---- **latus** (p. 14)
Urosome definitely wider than long, its posterior lobes broadly rounded; 2 anterior pairs of legs with flagella ---- **catostomi** (p. 14)
4. Posterior margin of basal plate of maxillipeds produced into 3 wide, laminate, and squarely truncated processes ---- **laticauda** (p. 15)
Posterior margin of basal plate of maxillipeds produced into 3 narrow and sharply pointed teeth ---- 5
5. Urosome as wide as long, its posterior lobes broadly rounded, the sinus between them with parallel sides ---- **megalops** (p. 16)
Urosome much longer than wide, its posterior lobes sharply pointed, the sinus between them with divergent sides ---- **alosae** (p. 17)

Remarks.—In the final verification of species the form and relative size of the respiratory areas and the detailed structure of the supporting rods of the sucking disks on the second maxillae will also give very satisfactory evidence. A triangular piece cut out of the side of one of the sucking disks and flattened under a cover glass will show the structural details of the supporting rods.

ARGULUS FUNDULI Krøyer

FIGURE 1

Argulus funduli KRØYER, Naturh. Tidsskrift, ser. 3, vol. 2, p. 94, pl. 2, figs. 1, *a–g*, 1863.—WILSON, Proc. U. S. Nat. Mus., vol. 25, p. 710, pl. 14, figs. 23–27, 1902.

Host and locality.—Outside surface of the two common killifishes at Woods Hole, *Fundulus heteroclitus* and *F. majalis*.

Distribution.—New Orleans, La. (Krøyer); Waquoit, Mass.; Long Island Sound, N. Y.; Beaufort, N. C. (Wilson).

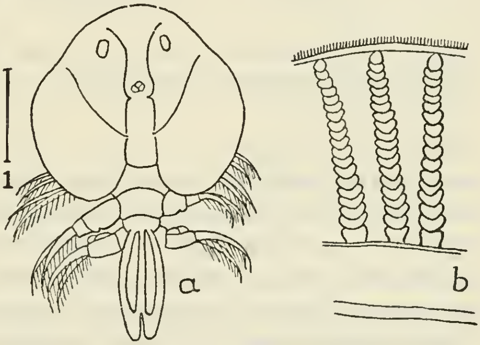

FIGURE 1.—*Argulus funduli*: *a*, Male, dorsal; *b*, supporting ribs in edge of sucking disk

Color.—Yellowish white mottled with pale rust color, the dorsal surface of the ovary and testes heavily spotted with dark brown; eyes and semen receptacles a lighter shade of brown.

Female.—Carapace orbicular, wider than long, the lateral lobes scarcely reaching beyond the second thoracic segment, the posterior sinus wider than deep; urosome less than one-third as long as the carapace, longer than wide, cut to its center, the posterior lobes bluntly rounded, caudal rami basal. No flagella. Teeth on basal plate of maxillipeds short and blunt, the inner one removed from the other two; maxillary disks enormous, the supporting rods 18- to 20-segmented, segments shaped like a stack of butter dishes. Anterior respiratory area some distance in front of posterior one and fully as wide. Total length, 4–5 mm. Width of carapace, 3–3.5 mm.

Male.—Carapace even shorter than in the female; urosome longer, half the length of the metasome, and three times as long as wide, not cut to the center, the posterior lobes acute or rounded. Basipods of third and fourth legs with wide posterior flaps, the peg on the fourth legs large and blunt; second legs unmodified. Total length, 3–4 mm. Width of carapace, 1.5–2 mm.

Remarks.—This species, like its two hosts, is found indiscriminately in salt or brackish water. It is not so common as would be expected from the abundance of its hosts.

ARGULUS LATUS Smith

FIGURE 2

Argulus latus SMITH, Rep. U. S. Comm. Fish and Fisheries, 1872–73, p. 574, 1873.—RATHBUN, Proc. U. S. Nat. Mus., vol. 7, p. 484, 1884.—WILSON, Proc. U. S. Nat. Mus., vol. 25, p. 704, pl. 9, figs. 1–4, 1902.

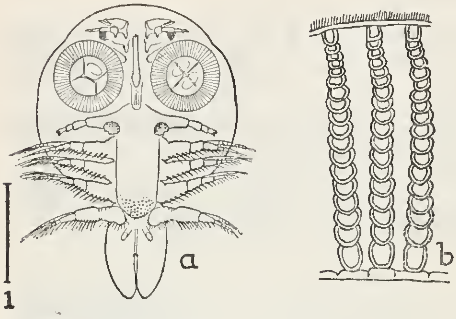

FIGURE 2.—*Argulus latus: a,* Female, ventral (drawn by Emerton); *b,* supporting ribs of sucking disk

Locality.—One female swimming freely at the surface in Vineyard Sound.

Distribution.—Casco Bay, Me. (Wilson).

Color (preserved material).—Body a uniform yellowish white, turning brownish in alcohol.

Female.—Carapace orbicular, wider than long, scarcely covering the second legs; posterior sinus one-fifth the length of the carapace, as wide as long; urosome longer than wide, cut one-third of its length, caudal rami basal, posterior lobes acute. Maxillary disks very large, one-fourth the width of the carapace, widely separated; each supporting rod made up of 18 segments, which are transversely lunate. Basal plate of maxillipeds slightly reentrant at the center of the posterior margin, without teeth or lobes. No flagella. Total length, 3 mm. Width of carapace, 2.5 mm.

Male.—Unknown.

Remarks.—This species may be recognized by its small size and by the absence of teeth or lobes on the basal plates of the maxillipeds.

ARGULIS CATOSTOMI Dana and Herrick

FIGURE 3

Argulus catostomi DANA and HERRICK, Amer. Journ. Sci., ser. 1, vol. 31, p. 297, pl. 1, 1837.—WILSON, Proc. U. S. Nat. Mus., vol. 25, p. 709, pl. 13, 1902.

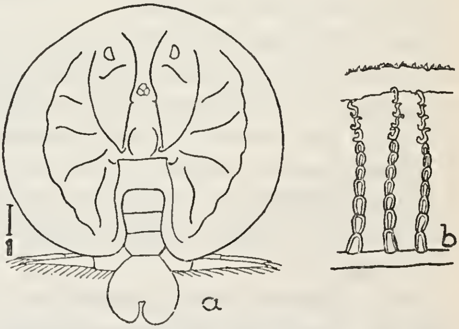

FIGURE 3.—*Argulus catostomi: a,* Female, dorsal; *b,* supporting ribs of sucking disk

Host and locality.—Outside surface of sucker, *Catostomus commersonii,* near New Haven, Conn., and at Woods Hole, Mass.

Distribution.—In fresh water at Warren and Chicopee, Mass. (Wilson); at the outlet of Lake Champlain on *Catostomus nigricans* and *C. catostomus* (Wilson); at Lake Maxinkuckee, Ind., on *C. catostomus* (Wilson).

Color.—Entire body a light sea green, faintly washed with yellow; eyes, semen receptacles, testes, and outlines of respiratory areas light cinnamon-brown. Male often light grayish brown without any tint of green; eyes brownish black, brain purple, testes covered dorsally with small circular purple spots; ventral surface of each testis with a longitudinal line of dark purple through the center, forked at the posterior end. Ventral surface of thorax and basipods of legs covered with small spots of brick red.

Female.—Carapace orbicular, wider than long, its lateral lobes usually overlapping the base of the urosome, but sometimes not reaching it; two anterior pairs of legs with flagella. Urosome relatively very small, orbicular, about as wide as long, cut one-third of its length, caudal rami basal; teeth on basal plate of maxilliped very wide and blunt, often only two in number. Smaller respiratory area set into the inner margin of the larger one near its center. Each supporting rib in the margins of the maxillary disks made up of 7 elliptical basal segments, 3 S-shaped segments, and a terminal crescentic segment. Total length, 10–12 mm. Width of carapace, about 11 mm.

Male.—Urosome relatively longer than in the female, one-third as long as the carapace; both basipod segments of fourth legs with a posterior flap; peg long and slender; proximal basipod segment of third legs transversely semilunar, posterior end a wide bluntly rounded flap, anterior end tapered to an acuminate point; proximal segment of second legs with two small flaps, one dorsal and one ventral, at its distal posterior corners. Total length, 5–6 mm. Width of carapace, 4–5 mm.

Remarks.—This is the oldest of our American argulids and is much the largest of those found in the Woods Hole area.

ARGULUS LATICAUDA Smith

FIGURE 4

Argulus laticauda SMITH, Rep. U. S. Comm. Fish and Fisheries, 1872–1873, p. 574, 1873.—RATHBUN, Proc. U. S. Nat. Mus., vol. 7, p. 484, 1884.—WILSON, Proc. U. S. Nat. Mus., vol. 25, p. 705, pl. 10, figs. 5–9, 1902.

Host and locality.—Outside surface of the eel, *Anguilla rostrata;* the winter flounder, *Pseudopleuronectes americanus;* the summer flounder, *Paralichthys dentatus;* the tomcod, *Microgadus tomcod;* the sculpin, *Myoxocephalus scorpius*, all at Woods Hole, Mass.

Distribution.—Never reported outside the Woods Hole region.

Color.—Body yellowish mottled with thick black pigment arranged in more or less radiating spots and bands, often so confluent as to make the copepod almost a uniform black. Pigment sometimes reddish brown or even purple, especially in smaller specimens.

Female.—Carapace elliptical, longer than wide, lateral lobes usually reaching the urosome; posterior sinus twice as deep as wide. Urosome orbicular, a little longer than wide, cut less than a quarter of its length, caudal rami basal. Anterior legs with flagella. Teeth on basal plate of maxillipeds broadly laminate and squarely truncated; respiratory areas very unequal in size, the smaller one anterior but touching the larger; each supporting rod of the maxillary disks short and threadlike, made up of 4 segments. Total length, 5–7 mm. Width of carapace, 3–4 mm.

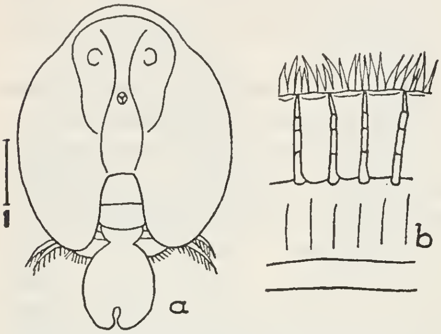

FIGURE 4.—*Argulus laticauda: a,* Female, dorsal; *b,* supporting ribs of sucking disk

Male.—Nearly as large as the female, with the same shape and proportions; basipod segments of second and third legs with fleshy posterior lobes, the distal ones narrow and fingerlike, the proximal ones broad and rounded; basipods of fourth legs with the regular boot-shaped lobes; peg short and rather blunt. Total length, 4–6 mm. Width of carapace, 3–4 mm.

Remarks.—This species may be recognized at once by its dark color, and it is often found in considerable numbers on the two flounder hosts.

ARGULUS MEGALOPS Smith

FIGURE 5

Argulus megalops SMITH, Rep. U. S. Comm. Fish and Fisheries, 1872–73, p. 575, 1873.—RATHBUN, Proc. U. S. Nat. Mus., vol. 7, p. 485, 1884.—WILSON, Proc. U. S. Nat. Mus., vol. 25, p. 706, pl. 11, figs. 10–13, 1902.

Host and locality.—Outside surface of winter flounder, *Pseudopleuronectes americanus;* summer flounder, *Paralichthys dentatus;* sand dab, *Hippoglossoides platessoides;* spotted flounder, *Lophopsetta maculata;* sea robin, *Prionotus carolinus;* long-horn sculpin, *Myoxocephalus octodecimspinosus;* goosefish, *Lophius piscatorius,* and in surface tow, all in the Woods Hole region.

Distribution—Not found thus far outside the present area.

Color.—Body yellowish or grayish with four pale-brown longitudinal stripes; entire upper surface of urosome in fully developed females reddish or pinkish brown, thickly sprinkled with minute black dots. Each lateral lobe of the carapace contains a branched design in black pigment; eyes, semen receptacles, and testes dark brown, almost black.

Female.—Carapace elliptical, longer than wide, the lateral lobes not reaching the urosome; posterior sinus broadly triangular and very shallow. Urosome elliptical, longer than wide, cut less than a fourth of its length, caudal rami basal. Teeth on basal plate of maxilliped long and blunt; the two portions of each respiratory area widely separated, the posterior one with a toothed outer margin; each supporting rod of the maxillary disks made up of a basal segment, enlarged at its distal end, and eight or nine short segments more or less telescoped. Swimming legs without flagella. Total length, 5–7 mm. Width of carapace, 3–4 mm.

Male.—Size, shape, and general proportions similar to those of the female. Proximal basipod segment of third legs with a large thumb-shaped process extending forward from the anterior distal corner; peg on fourth basipod in the form of a flattened spherical ball, attached to the leg by a short neck. Total length, 5–7 mm. Width of carapace, 3–4 mm.

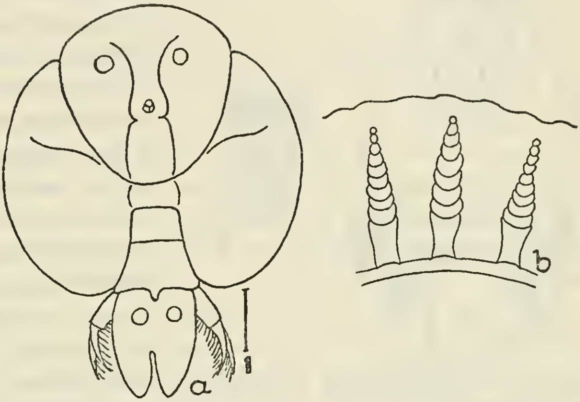

FIGURE 5.—*Argulus megalops: a*, Female, dorsal (variant); *b*, supporting ribs of sucking disk

Remarks.—This species has a larger number of hosts than any of the other argulids of the region, and it is worthy of note that all of them are fishes that frequent the bottom of the ocean.

ARGULUS ALOSAE Gould

FIGURE 6

Argulus alosae GOULD, Report on the Invertebrata of Massachusetts, p. 340, fig. 1, 1841.—RATHBUN, Proc. U. S. Nat. Mus., vol. 7, p. 485, 1884.—WILSON, Proc. U. S. Nat. Mus., vol. 25, p. 707, pl. 12, 1902.

Host and locality.—Outside surface and rarely the gill chamber of the common alewife, *Pomolobus pseudoharengus*, and the American smelt, *Osmerus mordax*, both in the Woods Hole region.

Distribution.—Patchogue, Long Island, N. Y., and Key West, Fla. (Wilson); Gulf of St. Lawrence on *Gasterosteus biaculeatus* (Whiteaves); Bass River, Nova Scotia, on *Microgadus tomcod* (Wilson).

Color.—Pale yellowish white, mottled along the lateral margins of the carapace and across its lateral lobes with a stippled design in cinnamon-brown. Eyes, testes, semen receptacles, and eggs dark reddish brown.

Female.—Carapace elliptical, one-third longer than wide, lateral lobes not reaching the urosome; swimming legs without flagella. Urosome elongate-elliptical, cut to the center or beyond, its lobes lanceolate-acuminate; caudal rami basal. Teeth on basal plate of maxillipeds short and sharp; anterior portion of each respiratory area much smaller than posterior; each supporting rod of maxillary disks made up of 10 segments, the basal one elongate, narrow, and bent, the others transversely lunate and diminishing in size distally. Total length, 6–12 mm. Width of carapace, 3–6 mm.

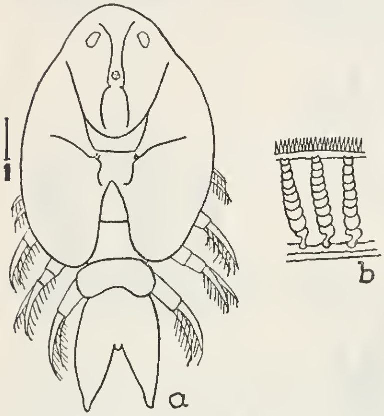

FIGURE 6.—*Argulus alosae: a,* Female, dorsal; *b,* supporting ribs of sucking disk

Male.—Size, shape, and general proportions of metasome same as in the female; urosome relatively longer and narrower, the testes extending beyond the base of the posterior sinus. Distal segment of fourth basipod with a short almost spherical peg; semen vesicle in basipod of third legs, no other sexual modifications. Total length, 5–9 mm. Width of carapace, 3–5 mm.

Remarks.—From the above distribution it will be seen that this species is found along our entire Atlantic coast, and although the alewife is its normal host, it may also be looked for upon other fishes.

Suborder CALANOIDA

Fifth thoracic segment firmly attached to the fourth, but forming a movable articulation with the sixth. Metasome considerably depressed and much wider than the urosome, which is abruptly narrowed. Female genital openings paired on the ventral surface of the genital segment, male opening single, placed asymmetrically on the left side. Anterior antennae elongate, many jointed, the right or the left one in the male usually transformed into a grasping organ. Posterior antennae biramose, endopod usually 2-segmented, its terminal segment 2-lobed and armed with many plumose setae. Eggs carried in a single ovisac attached to the ventral surface of the genital segment, rarely deposited singly. Includes free-swimming forms only, which mostly frequent the open ocean, floating at or near the surface, often in immense shoals, but sometimes found in fresh or brackish water.

Remarks.—In this group the fifth legs are normally made up of a 2-segmented basipod and one or two rami, also more or less segmented. In the key to the genera of the group (Appendix B, p. 540), when the fifth legs are biramose, the number of segments given are those of the rami alone, without including the basipods. But when the fifth legs are uniramose it seems advisable to give the entire number of segments in each leg, including the basipod segments, the proximal of which is more or less fused with the same segment in the other leg, and with the ventral surface of the fifth segment. The statement that a pair of uniramose fifth legs is 1-segmented means that there is but a single visible segment in the entire leg on either side. Theoretically, we might assume, as Giesbrecht has done, that in each leg there are 2 basipod segments, so fused with each other and with the ramus of the leg as to be indistinguishable. The key, however, is for the sole purpose of facilitating the recognition of the various genera. It should include, therefore, only those things that are actually visible and should present them as they really appear.

The number of segments in the rami of the swimming legs is not always constant for any given genus. In the genus *Temora*, for example, the exopods of the first 4 pairs of legs have normally 3 segments. But sometimes the separation of the two proximal segments is so completely hidden that the ramus is apparently only 2-segmented. Such genera, as far as seemed advisable, have been included twice in the key, once as showing a ramus with 2 segments, and again as showing one with 3 segments. Furthermore, the segmentation of the swimming legs is not always the same in the two sexes of the same genus. In such cases the sexes have necessarily been separated and appear in different portions of the key.

The normal habitat of each genus is also indicated, and is of value chiefly in separating the genera that inhabit fresh, brackish, and salt water. But it also serves to suggest what forms are likely to be taken in surface towing and what forms are more or less confined to the bottom plankton, with the depths at which they have been obtained.

Family CALANIDAE

Genus CALANUS Leach, 1819

Head either fused with the first segment or separated from it; fourth and fifth segments separated; urosome of female 4-segmented, of male 5-segmented, symmetrical; caudal setae symmetrical, second inner one the longest. First antennae usually longer than the body; exopod of second antennae 7-segmented. Rami of all 5 pairs of legs 3-segmented, exopods with 1, 1, 2 outer spines and an end spine shaped like a scalpel; first endopod with 1, 2, 6 setae, end segments of second and third endopods with 8 setae, of fourth endopod with 5 setae. Fifth legs asymmetrical in male, the left leg the stronger. Widely distributed and present in all the oceans.

KEY TO THE SPECIES (BOTH SEXES)

1. First basipod of fifth legs with its inner margin naked, or armed with short setae or hairs---------------------------------- **tonsus** (p. 20)
   First basipod of fifth legs with its inner margin armed with coarse spines arranged like saw teeth---------------------------------- 2
2. Posterior corners of fifth thoracic segment pointed---- **hyperboreus** (p. 21)
   Posterior corners of fifth thoracic segment rounded---------------------- 3
3. Head fused with first thoracic segment-------------------- **minor** (p. 22)
   Head separated from first thoracic segment------------------------------ 4
4. Caudal rami twice as long as wide or more; left fifth endopod of male three-fourths as long as exopod----------- **finmarchicus** (p. 23)
   Caudal rami less than twice as long as wide; left fifth endopod of male less than half as long as exopod---------- **helgolandicus** (p. 25)

CALANUS TONSUS Brady

Figure 7

Calanus tonsus Brady, Voyage of H. M. S. *Challenger*, vol. 8, pt. 23, Copepoda, p. 34, pl. 4, figs. 8–9, 1883.—Giesbrecht and Schmeil, Das Tierreich, Lief. 6, Copepoda, p. 19, 1898.

Occurrence.—Five females from Georges Bank in surface tows; 6 females in a vertical haul at Station 20107, *Grampus*, east of Cape Cod.

Distribution.—Atlantic and Pacific Oceans (Brady); northern Pacific and Queen Charlotte Islands (Willey); Gulf of Guinea (T. Scott); Madeira and Canary Islands (Thompson).

Color.—Body colorless, transparent, and not easy to detect in ordinary seawater. No pigment markings of any kind, except in one specimen a faint pink spot inside the body cavity above the mouth (Rathbun).

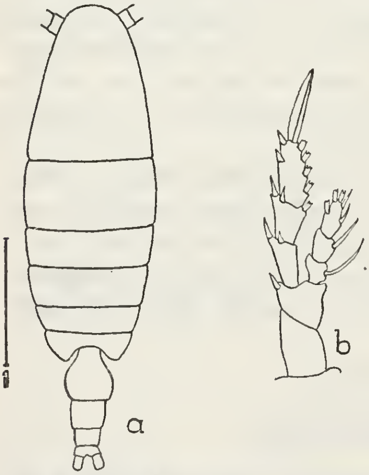

Figure 7.—*Calanus tonsus: a*, Dorsal surface of female; *b*, fifth leg

Female.—Head distinctly separated from the first thoracic segment; first antennae as long as the body and armed with small and scattered setae, except on the three apical segments. Genital segment broad and swollen, one-half wider than the abdomen; inner margins of fifth basipods naked, without spines or setae. Total length, 3.6 mm.

Male.—Unknown.

Remarks.—This species is widely distributed, but nowhere abundant; it seems to prefer the open ocean and is not likely to be found near the shore. It may be recognized by the swollen genital segment and the absence of spines and setae on the inner margins of the fifth basipods.

CALANUS HYPERBOREUS Krøyer

Figure 8

Calanus hyperboreus Krøyer, Kong. Danske Vid. Selsk. Nat. Math. Afh., vol. 7, p. 310, pl. 4, 1838.—Sars, Crustacea of Norway, vol. 4, p. 12, pl. 5, 1901.

Occurrence.—Fifteen males and females in trawl wings, Station 1029, *Fish Hawk*, 4 males and females at surface, Station 981, *Fish Hawk;* 1 female at surface, Station 1107, *Fish Hawk;* 4 females in trawl wings, Station 2195, *Albatross;* 300 males and females and many development stages at various stations of *Grampus* in Gulf of Maine.

Distribution.—Finmark and Norwegian coast (Sars); North Atlantic (Cleve); Greenland, Spitzbergen (Krøyer, Lilljeborg); North Sea (Buchholz); Baffin Bay (Norman); Jan Mayen Island (Sars); Arctic seas (Mrázek); Bering Strait (van Breemen); Barents Sea, Davis Strait (Vanhöffen, Stephensen); Denmark Strait, Iceland, Faroe Channel (With).

Color.—Entirely transparent except two elongate red spots on the midline nearer the ventral surface. One of these is near the middle of the cephalic segment, the other at the posterior end of the body. The bases of the first antennae are transparent; then two longitudinal red stripes become distinguishable under a hand lens and extend a little more than half the entire length of the antennae. They are followed by a single stripe running half the remaining distance, and the tips are colorless and transparent like the base (Rathbun).

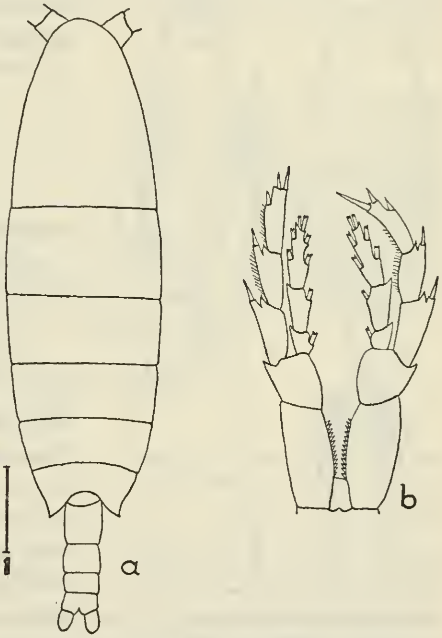

Figure 8.—*Calanus hyperboreus: a,* Dorsal surface of female; *b,* fifth leg of male

Female.—Head separated from the first segment; fifth segment pointed at its posterior corners; first antennae extending for about three segments beyond the tips of the caudal rami. First basipods of fifth legs elongated and irregularly toothed on their inner margins. Total length, 7–10 mm.

Male.—Considerably smaller than the female, with the fifth segment a little less sharply pointed at the posterior corners; left fifth exopod longer than the right, its terminal segment narrowed and turned inward; left endopod reaching well beyond the center of the end segment of the exopod; in the right leg the endopod does not reach the center of the last segment of the exopod. Total length, 6–7 mm.

Remarks.—This is one of the largest calanoids and may be recognized by its size and the length of the first antennae. Its distribution indicates that it is an arctic species, but it is common in the Gulf of Maine and in the winter extends southward at least to the Gulf Stream. In economic importance its large size somewhat compensates for its rather meager numbers. Sars regarded it as a "relict" species.

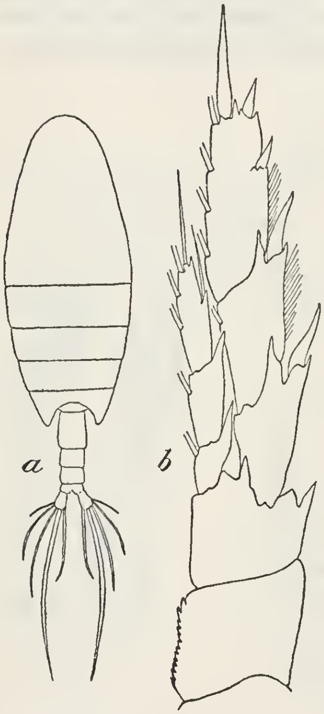

FIGURE 9.—*Calanus minor: a,* Female, dorsal; *b,* fifth leg

CALANUS MINOR (Claus)

FIGURE 9

Cetochilus minor CLAUS, Die frei lebenden Copepoden, p. 172, 1863.
Calanus minor GIESBRECHT and SCHMEIL, Das Tierreich, Lief. 6, Copepoda, p. 15, 1898.

Occurrence.—Eight males and females from trawl wings, Stations 981, 985, 992, *Fish Hawk;* 100 males and females from trawl wings, Stations 2195, 2204, 2236, *Albatross;* 2 females surface tow, Georges Bank; 20 males and females, surface tow 75 miles south of Gay Head; 6 females surface tow, Station 20106, *Grampus.* All except the last were taken by Rathbun.

Distribution.—Messina (Claus); Australia (Brady); Canary Isles and Malta (Thompson); tropical Atlantic (Giesbrecht); tropical Pacific, Indian Ocean (Giesbrecht); California coast (Esterly); Adriatic (Steuer); Mediterranean, Red Sea, Indian Ocean (Thompson and Scott); Woods Hole, Mass. (Wheeler); Arabian Sea, Malay Archipelago (Cleve).

Color.—Entire body varying from pink to bright orange-red, the color not constant but very irregularly distributed. It is generally most intense through the center of the body and in the head. The outside surface is covered with fine spots of a deeper red, these freckles being most numerous from the center to the front. Some of the appendages, as well as the caudal rami, occasionally show similar spots. The bases of the first antennae are colorless, with irregular red spots; then the color becomes continuous and extends to the tips, where it becomes fainter than at the center (Rathbun).

Female.—Head fused with the first segment; fifth segment rounded at its posterior corners; first antennae not reaching the caudal rami. Distal margin of the second segment of the basipod of the second, third, and fourth legs armed with spines; inner margin of the first basipod of the fifth legs with a straight edge, more coarsely toothed than in *finmarchicus*. Total length, 1.75–2 mm.

Male.—A little smaller than the female, the first antennae bent in the shape of the letter S. The terminal segments of the right fifth exopod with only 2 inner setae and a short terminal spine; the terminal segment of the left endopod with 3 setae. Total length, 1.7–1.8 mm.

Remarks.—This is the smallest of the calanoids in the Woods Hole region and can be recognized by that character alone. It was recorded by Wheeler from the Gulf Stream south of Marthas Vineyard, and neither Sharpe nor Fish found it in the immediate vicinity of Woods Hole. This indicates that it is pelagic in habit and is seldom driven in near the shore. Although Wheeler's specimens came from surface tows, Rathbun's were mostly obtained from the trawl wings, some of them from depths of 1,500 fathoms.

CALANUS FINMARCHICUS (Gunner)

Figure 10

Monoculus finmarchicus Gunner, Skrifte Kjöbenhavnske Selskabet, vol. 10, p. 175, figs. 20–23, 1765.

Calanus finmarchicus Sars, Crustacea of Norway, vol. 4, p. 9, pls. 1–3, 1901.

Occurrence.—Forty males and females from trawl wings, Stations 1039, 1089, 1107, 1139, 1141, *Fish Hawk;* 25 males and females from trawl wings, Stations 2096, 2195, *Albatross;* 50 males and females in surface tow in Woods Hole harbor; 60 males and females in surface tow, Georges Bank; 1.500 males and females at Stations 10253, 10280, 10306, 10328, 20044, 20048, 20076, 20178, *Grampus*, in the Gulf of Maine.

Distribution.—Everywhere in all the oceans, including the Arctic and Antarctic, and along both the Atlantic and Pacific coasts of America.

Color.—Almost entirely transparent and colorless, but always showing a few irregular streaks of orange-red, blood red, or crimson in the posterior part of the body on the walls of the intestine. Some specimens have much of this coloring matter, while others have very little; it sometimes appears in streaks, sometimes in blotches, and rarely in a combination of the two. On the ventral surface there is also a large spot of coloring for each segment. In the first segment this lies along the median line and appears to be between the bases of the mouth parts; in the other segments it is very irregularly arranged. The eye is deep red (Rathbun).

Female.—Head separated from the first segment; fifth segment with rounded posterior corners; first antennae reaching for about three segments beyond the tips of the caudal rami; distal margin of the second segment of the basipod of the second, third, and fourth legs armed with spines; inner margin of first basipod of fifth legs concave and armed with small teeth. Total length, 2.75–6.5 mm.

Male.—Considerably smaller than the female, the first antennae straight and reaching 3 or 4 segments beyond the tips of the caudal rami. Fifth legs quite asymmetrical, left basipod and proximal segment of the exopod elongated, the distal exopod segment shortened. No setae on either exopod, but a fringe of short hairs on the inner margin of the left one, which is considerably longer than the right. Total length, 2.5–4 mm.

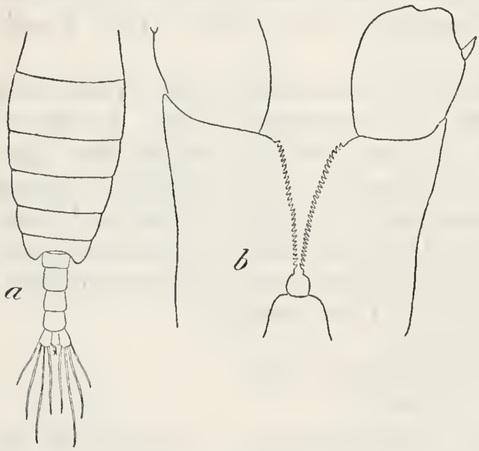

FIGURE 10.—*Calanus finmarchicus: a,* Female, dorsal; *b,* fifth legs. (From W. M. Wheeler)

Remarks.—This is by far the most abundant copepod in the Woods Hole region, and the one of greatest economic importance. It is much more a pelagic than a littoral species, but occurs abundantly in Narragansett Bay, Buzzards Bay, Vineyard Sound, and even in Woods Hole Harbor, particularly in winter and early in summer. It has the habit of gathering in immense swarms or shoals, usually offshore, so that its distribution is very irregular. For this reason it is the only copepod of those here enumerated that is likely to constitute an entire catch. Sars said that it sometimes occurs on the Norwegian coast in such great numbers as to give the sea a reddish hue. It is eagerly eaten by most food fishes during their development, and by some, as the herring and mackerel, after they become adults. Its large size combined with its great abundance makes it the most important food of our plankton-feeding fishes. This copepod differs from most calanids in that its eggs are deposited singly and float about in the water until hatched. The eggs, the newly hatched nauplii, and the various developmental stages are easily recognized in the plankton, and have been described by Damas, 1905, and by Lebour, 1916.

CALANUS HELGOLANDICUS (Claus)

FIGURE 11

Cetochilus helgolandicus CLAUS, Die frei lebenden Copepoden, p. 171, pl. 26, figs. 2–9, 1863.

Calanus helgolandicus SARS, Crustacea of Norway, vol. 4, p. 11, pl. 4, 1901.

Occurrence.—Ten males and females from trawl wings, Stations 951, 986, 993, *Fish Hawk;* 2 females in vertical net, Station 10245, *Grampus.*

Distribution.—British Isles (Brady); coast of France (Canu); Mediterranean (Giesbrecht); Black Sea (Karawajew); Norwegian coast (Sars); Australian coast (Brady); Chesapeake Bay (Wilson).

Color.—Those from Station 951 showed blotches of reddish along the ventral edges of the segments and at the posterior end of the body; lines of vermilion also sometimes appeared between the segments, but were more often wanting. In the lot obtained at Station 993 the entire body was of a bright pink by lamplight. (Rathbun.)

Female.—Head separated from the first segment; fifth segment with rounded posterior corners; first antennae reaching about 2 segments beyond the tips of the caudal rami; caudal rami scarcely longer than the anal segment; inner margin of first basipod of fifth legs concave and armed with coarse teeth. Total length, 2.75–3.25 mm.

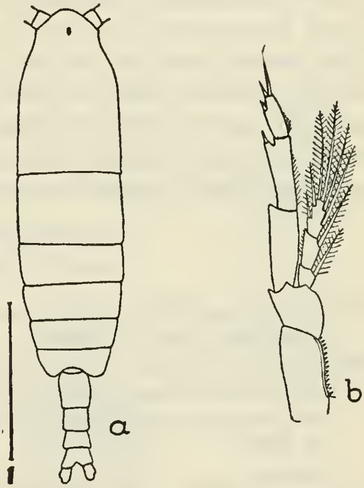

FIGURE 11.—*Calanus helgolandicus: a,* Female, dorsal surface; *b,* male, left fifth leg

Male.—Smaller than the female; first antennae relatively a little longer, extending three or four segments beyond the caudal rami. Fifth legs quite asymmetrical, both left basipods and the two proximal exopod segments elongated, the distal exopod segment only half the length of the second segment, the left endopod reaching but little beyond the first segment of the exopod. Right leg much shorter than the left, its endopod reaching well beyond the base of the end segment of the exopod. Total length, 2.5–2.8 mm.

Remarks.—Most recent authors regard this species as a synonym of *finmarchicus*, but Sars gave sufficient reasons for restoring it as a separate species. It is worthy of note that Rathbun in his manuscript notes regarded it as a distinct species and added the following interesting observation: "Several thousand specimens of a *Sagitta*, probably *Sagitta elegans*, came up in the trawl wings at Stations 985 and 986, *Fish Hawk.* Nearly every one of these Sagittas had a single copepod of the present species in its digestive tract, forming a large bright pinkish spot, distinctly visible to the naked eye. This would indicate that the Sagittas feed upon these copepods and that the latter constitute an important factor in their diet.

Genus MEGACALANUS Wolfenden, 1904

Head separated from the first segment, or fused with it; fourth and fifth segments separated; first antennae reaching for many segments beyond the caudal rami. All 5 pairs of legs biramose, the rami 3-segmented; anterior surface of the distal segment of the first basipod with or without a stout hook, to which is articulated a strong plumose seta; terminal segments of second, third, and fourth exopods each with three spines on the outer margin; fifth legs symmetrical, inner margins of basipods naked. Caudal rami short, each with six setae, the third inner one a little the longest. One species.

MEGACALANUS PRINCEPS (Brady)

FIGURE 12

Calanus princeps BRADY, Voyage of H. M. S. *Challenger*, vol. 8, pt. 23, Copepoda, p. 36, pl. 4, figs. 3-7, 1883.

Macrocalanus princeps SARS, Bull. Mus. Océanogr. Monaco, no. 26, p. 7, 1905.

Megacalanus princeps SARS, Résultats des campagnes scientifiques accomplies sur son yacht par Albert Ire, Prince Souverain de Monaco, fasc. 69, p. 14, pl. 3, 1925.

Occurrence.—Three females from trawl wings at Stations 954, 994, *Fish Hawk*, south of Nantucket and Marthas Vineyard.

Distribution.—Irish seas (Farran, Pearson); North Atlantic (Brady); Antarctic Ocean (Wolfenden).

Color.—The coloring is very bright and the effect beautiful, as it is one of the most brilliantly colored species of our coast. The longer antennae are colorless, and the end of the snout is whitish and translucent. Thence the color is yellowish white to one-fourth the length of the anterior segment from its posterior end. Here a light pink begins, which deepens and extends to the hinder end of the thorax and into the abdomen. This is an internal coloring and does not reach the surface. Externally there is another red coloration, a bright, glistening blood red, arranged in bands and spots, the bands consisting of closely joined spots. The genital segment is almost entirely made up of this color, the abdomen being white. The red on the upper part of the body is most thickly distributed along the middle of the back from the front of the second segment to the genital segment, forming two to four closely arranged lines of spots, more or less continuous in the second and third segments, but much broken posteriorly. Midway down the sides another marked line of these spots occurs, being continuous from the posterior end of the first segment to the posterior end of the fifth segment. Between the lateral lines and the back are a few scattered and broken series of spots. From the lateral lines to the ventral margins this color forms broad bands at the junction of the segments, and occasional smaller ones between. The mouth appendages are whitish. There is a small internal reddish spot behind the snout and another much larger one farther back, neither of which seems in the right position for the eye (Rathbun).

Female.—Metasome two and a half times as long as wide; head with a low crest; genital segment swollen both centrally and dorsally, decidedly wider and thicker than it is long. First antennae reaching at least 6 segments beyond the tips of the caudal rami; fifth legs symmetrical, the endopods extending nearly to the center of the last segment of the exopod. Total length, 12–13.5 mm.

Male.—Unknown.

Remarks.—The specimens that served as the types of Brady's species were obtained from our own Atlantic coast, not far from the two *Fish Hawk* stations where the present specimens were found, but in deeper water (1,250 fathoms).

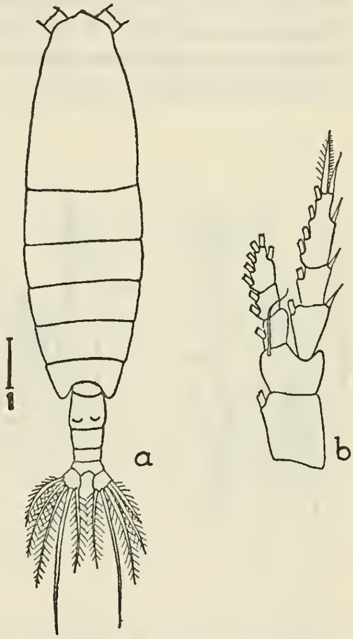

FIGURE 12.—*Megacalanus princeps:* *a*, Female, dorsal; *b*, fifth leg

This is the largest of our copepods and may be recognized by that fact alone; the first antennae also are nearly one-half longer than the whole body. Brady said of his specimens mentioned above: "I am disposed to think, seeing that all the specimens have been obtained from the dredge, that this species is really an inhabitant of the deep sea."

Genus NEOCALANUS Sars, 1925

Head separated from, or fused with, the first segment; fourth and fifth segments separated; first antennae reaching well beyond the caudal rami. All five pairs of legs biramose, the rami 3-segmented; anterior surface of basipod of first legs with or without a spine; end segments of second, third, and fourth exopods each with two spines on the outer margin. Basal half of the outer margin of the end segment of the fourth exopod ciliated in the female, dentate in the male. Fifth legs symmetrical in female but quite asymmetrical in male, the left exopod without setae, the endopod often rudimentary; inner margin of basipods naked. Caudal rami short, each with six setae, the third inner one greatly elongated. One species.

NEOCALANUS GRACILIS (Dana)

Figure 13

Calanus gracilis Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 18, 1849.
Megacalanus gracilis A. Scott, *Siboga*-Expeditie, 29a, Copepoda, pt. 1, p. 12, 1909.
Neocalanus gracilis Sars, Résultats de campagnes scientifiques du Prince de Monaco, fasc. 69, p. 7, 1925.

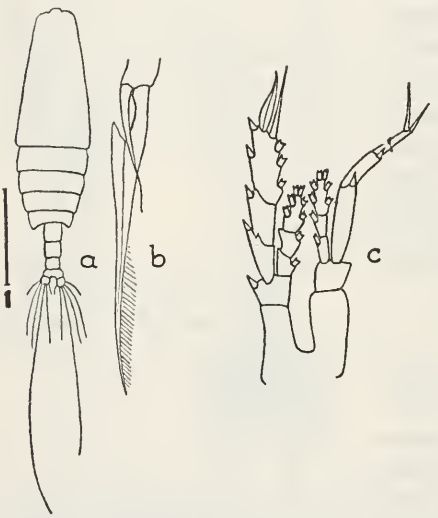

Figure 13.—*Neocalanus gracilis*, female: *a*, Dorsal surface; *b*, end spine of first exopod; *c*, fifth legs of male

Occurrence.—Fifteen males and females from trawl wings, Stations 2183, 2195, *Albatross;* 7 females in vertical net, Station 10331, *Grampus*, Gulf of Maine.

Distribution.—Tropical Atlantic (Dana); Mediterranean, tropical Atlantic, tropical Pacific (Giesbrecht); Gulf of Guinea (Lubbock); Messina (Claus); Philippines (Brady); Canary Isles and Malta (Thompson); Indian Ocean (van Breemen).

Color.—Body as a whole colorless, transparent, and very difficult to see in the water, but the appendages are more or less red or pinkish, and the overlapping margins of the four posterior thoracic segments form narrow transverse lines of deep vermilion, most pronounced dorsally, gradually fading out ventrally. Directly above the mouth and often at the posterior end of the thoracic cavity there are internal blotches of a blood-red color mixed with yellow. A few much smaller spots of the same color are irregularly distributed along the sides and at the ventral edges of the segments. The eye is bright vermilion.

Female.—Head fused with first segment of thorax; fifth segment with rounded posterior corners; second inner seta of left caudal ramus much longer than the corresponding one on the right ramus. First antennae at least half as long again as the entire body, with one or more enlarged plumose setae near the distal end. Distal segment of basipod of first legs with a strong hook on its anterior surface; first basipod segment of fifth legs with setae on its inner margin. Total length, 3–3.25 mm.

Male.—Head separated from first segment of thorax; first antennae straight; mouth parts strongly retrograde. End segments of the second, third, and fourth exopods with their outer margins toothed; fifth legs like the fourth, but the basipods and the first and second segments of the left exopod are considerably lengthened, while the end segment is shortened. Total length, 2.5–2.85 mm.

Remarks.—This is evidently a tropical species, but comes north in the Gulf Stream and is likely to be found anywhere within the present area. It is a small species and can be recognized by the curved hook on the anterior surface of the first basipods, which is a constant character. Its small size and limited numbers make it of little economic value.

Genus UNDINULA A. Scott, 1909

Head fused with the first segment; fourth and fifth segments separated; urosome symmetrical and 4-segmented. Rami of the first four pairs of legs 3-segmented; the second segment of the second exopod in both sexes deeply notched in the species here included. Fifth legs of female like the other pairs, rami 3-segmented; right leg of male much reduced in size, biramose, the rami 3-segmented, the endopod considerably smaller than the exopod; left leg uniramose, or with a rudimentary 1-segmented endopod; exopod greatly enlarged, its end segment converted into a powerful 2-parted prehensile organ. One species.

UNDINULA VULGARIS (Dana)

FIGURE 14

Undina vulgaris DANA, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 22, 1849.
Undinula vulgaris A. SCOTT, *Siboga*-Expeditie, 29a, Copepoda, pt. 1, p. 16, 1909.

Occurrence.—Twenty-five males and females from trawl wings at Stations 2204, 2210, 2219, *Albatross;* 10 males and females from surface tow on Georges Bank, September 15, 1874.

Distribution.—Tropical Atlantic, Samoa Islands, Sulu Sea, Banca Straits (Dana); Australia, New Guinea, Philippines, Hawaiian Islands, Fiji Islands, tropical Atlantic (Brady); Hong Kong, Atlantic and Pacific Oceans (Giesbrecht); tropical Atlantic (Cleve); Red Sea, Indian Ocean (Thompson and Scott); Arabian Sea, Malay Archipelago (Cleve).

Color.—Entire body a uniform brick red, which persists even after 40 years' preservation in strong alcohol.

Female.—Head fused with the first segment; fifth segment with pointed posterior corners turned ventrally; caudal setae symmetrical; first antennae just reaching the caudal rami; inner margin of fifth basipods armed with setae. Outer margin of second segment of second exopod with a deep notch at its proximal corner, armed with a spine. Total length, 2.4–2.85 mm.

Male.—Head fused with first segment; first antennae curved in the form of an S, and a little longer than in the female. Right fifth leg very short, endopod 3-segmented, without setae and tipped with two spines; exopod 3-segmented, without setae, but with a process on the outer margin of the middle segment, shaped like a slender finger. Left fifth leg without an endopod, the second basipod segment greatly elongated, the exopod enlarged and 3-segmented, the basal and second segments armed with long, sharp-pointed, curved claws, the terminal segment tipped with a wormlike process. Total length, 2.25–2.5 mm.

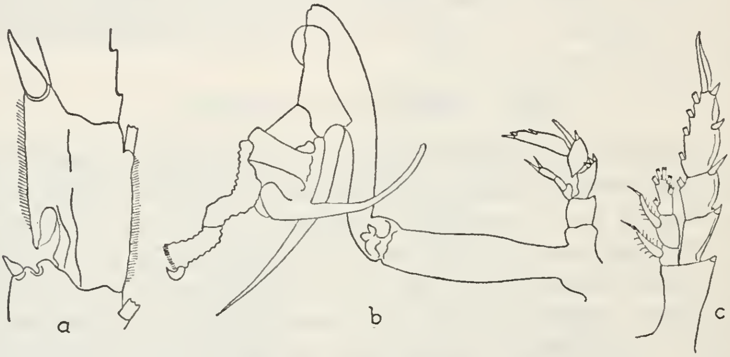

FIGURE 14.—*Undinula vulgaris: a,* Second segment of second exopod; *b,* fifth legs of male; *c,* fifth leg of female

Remarks.—This species, like the preceding one, prefers the tropical parts of the ocean, but goes north in the Atlantic at least to latitude 41° N. Although it is very cosmopolitan and is found in all the oceans, the present is the first record of its occurrence on our American shores. The highly modified fifth legs of the male, the elongated left fifth exopod of the female, and the peculiar invagination of the second exopod in both sexes furnish convenient characters for the identification of the species.

Genus EUCALANUS Dana, 1852

Head triangular, often elongated and fused with the first segment; rostrum produced into threadlike filaments; first antennae reaching beyond the caudal rami, sometimes unequal in length, with colored plumose setae at their tips; endopod of second antennae longer than exopod. Exopods of first four pairs of legs 3-segmented, first endopod 2-segmented, the next three 3-segmented; fifth legs lacking in female, uniramose in male, one leg sometimes lacking.

KEY TO THE SPECIES

FEMALES

1. Urosome made up of 4 segments ---- elongatus (p. 31)
Urosome made up of 3 segments ---- 2
2. Head indented on either side of the frontal margin; genital segment distinctly longer than wide ---- attenuatus (p. 32)
Head without indentations on the frontal margin; genital segment distinctly wider than long ---- monachus (p. 33)

MALES

1. Both fifth legs present ---- 2
Right fifth leg entirely lacking ---- monachus (p. 33)
2. Exopod of second antenna just reaching distal margin of first segment of endopod; left fifth leg shorter than fourth leg ---- attenuatus (p. 32)
Exopod of second antenna scarcely reaching middle of first segment of endopod; left fifth leg as long as fourth leg ---- elongatus (p. 31)

EUCALANUS ELONGATUS (Dana)

Figure 15

Calanus elongatus Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 18, 1849.
Eucalanus elongatus Giesbrecht and Schmeil, Das Tierreich, Lief. 6, Copepoda, p. 20, 1898.

Occurrence.—Twenty-five males and females from the trawl wings at Stations 2093, 2173, 2195, 2219, 2236, 2230, *Albatross*, southwest of Marthas Vineyard.

Distribution.—Sulu Sea (Dana); Nizza (Claus); East Indies (Streets); Mediterranean, Pacific coast of South America (Giesbrecht); California coast (Esterly); North Atlantic (Cleve); Indian Ocean (Thompson); Iceland, Fargo Channel (With); Gulf of Maine (Bigelow).

Color.—Usually colorless and very transparent; eye small and bright red. There is sometimes a varying degree of red in the body, now limited to a single oil drop near the posterior end of the thorax, again confined to a small spot at the base of the mouth parts, occasionally in scattered blotches.

Female.—Head regularly triangular; fifth segment with spines at the posterior corners; genital segment longer than wide; urosome 4-segmented; second inner seta of right caudal ramus elongated. Proximal segment of the endopod of the second antennae more than three times as long as wide, and one-fifth longer than the distal segment. Total length, 5.75–8.5 mm.

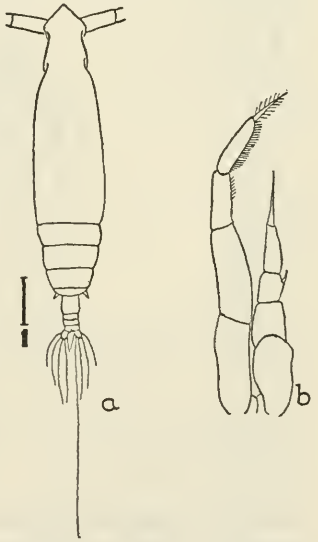

Figure 15.—*Eucalanus elongatus:* *a,* Female, dorsal; *b,* fifth legs of male

Male.—Head bluntly rounded anteriorly; genital segment a trifle wider than long; urosome 5-segmented; left caudal ramus wider and longer than the right, its second inner seta elongated; both fifth legs present, the tip of the right leg just reaching the distal end of the second segment of the left leg. Total length, 3.75–5 mm.

Remarks.—This species has been reported from the Atlantic as far north as latitude 61° N. Bigelow found it to be fairly common in the Gulf of Maine, but nowhere abundant, and hence not possessing much economic importance. He characterized it as a "rare stray" from the warmer and saltier portions of the Atlantic outside of the continental edge. Hence its appearance in the present area will be more or less accidental and probably in comparatively small numbers.

EUCALANUS ATTENUATUS (Dana)

FIGURE 16

Calanus attenuatus DANA, Proc. Amer. Acad. Arts. and Sci., vol. 2, p. 18, 1849.
Eucalanus attenuatus GIESBRECHT and SCHMEIL, Das Tierreich, Lief. 6, Copepoda, p. 20, 1898.

Occurrence.—Three females from trawl wings at Stations 2195, 2219, *Albatross*, south of Nantucket.

Distribution.—Western Mediterranean (Giesbrecht); Messina and Nizza (Claus); Red Sea, Indian Ocean (Thompson and Scott); Malay Archipelago (Dana, Cleve); Kingsmill Island, China Sea (Dana); off Nova Scotia (Willey); Gulf of Maine (Bigelow); tropical Atlantic and Pacific (Giesbrecht).

Color.—Transparent with a variable degree of red pigment irregularly and often very asymmetrically distributed in the body, some of the basal segments of the first antennae, and the terminal segments of the appendages. The plumes at the tips of the first antennae are usually bright orange with a bluish or violet iridescence.

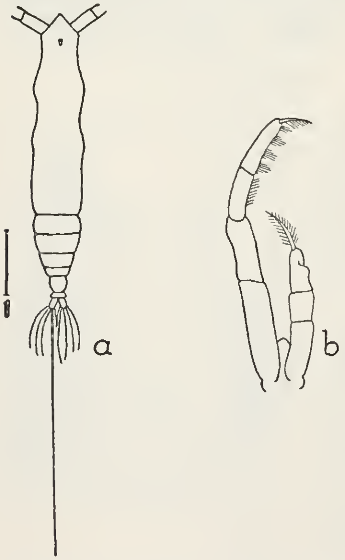

FIGURE 16.—*Eucalanus attenuatus*: *a*, Female, dorsal; *b*, fifth legs of male

Female.—Head triangular with an indentation on either side of the frontal margin, strongly narrowing the part in front of it; fifth segment rounded at the posterior corners; genital segment longer than wide; urosome 3-segmented; caudal rami symmetrical, second inner seta of left ramus elongated; proximal segment of endopod of second antenna four times as long as wide and one-third longer than the distal segment. Total length, 4–5 mm.

Male.—Head triangular, without the marginal indentations, but narrowed somewhat anteriorly; genital segment wider than long; urosome 4-segmented; caudal rami and second antennae as in the female; both fifth legs present, the tip of the right leg scarcely reaching the center of the second segment of the left leg. Total length, 3–3.5 mm.

Remarks.—Wheeler secured a single female of this species at the surface in the Gulf stream south of Marthas Vineyard. It is pelagic and not likely to be found anywhere near shore.

EUCALANUS MONACHUS Giesbrecht

FIGURE 17

Eucalanus monachus GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 132, pls. 11, 35, 1892.

Occurrence.—A single male was taken by Wheeler in the Gulf Stream south of Marthas Vineyard; no specimens were found in Rathbun's collections.

Distribution.—Western Mediterranean (Giesbrecht); Malay Archipelago (Cleve); South Africa (Cleve); Adriatic (Steuer); Indian Ocean off Ceylon (Thompson and Scott); Gulf Stream south of Marthas Vineyard (Wheeler).

Color.—This species has never been examined while alive, and hence its color remains unknown.

Female.—Head semielliptical and not triangular; forehead elongated and evenly rounded; fifth segment with rounded posterior corners; genital segment wider than long; urosome 3-segmented; caudal rami slightly asymmetrical, second inner seta of left ramus elongated; proximal segments of second antenna twice as long as wide and shorter than the distal segment. Total length, 2–2.35 mm.

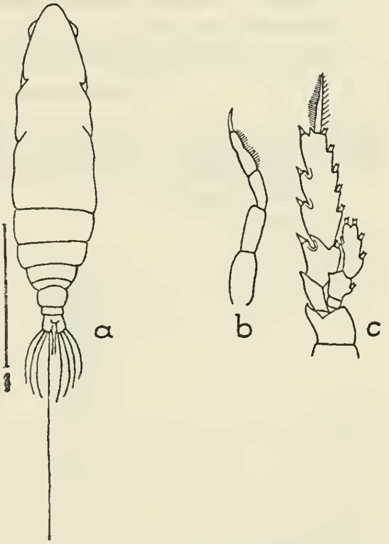

FIGURE 17.—*Eucalanus monachus:* *a*, Female, dorsal; *b*, left fifth leg of male; *c*, fourth leg

Male.—Head evenly rounded anteriorly; third thoracic segment with a pair of stout setae at each posterior corner, which stand out prominently from the sides of the body. Right fifth leg lacking, left one 4-segmented. Total length, 2–2.25 mm.

Remarks.—Wheeler's single male still remains the only specimen thus far obtained from the Woods Hole area. The species can be recognized in the female by the comparative width of the genital segment, and in the male by the absence of the right fifth leg.

Genus RHINCALANUS Dana, 1852

Head produced anteriorly into a conical process, which carries on its ventral surface the rostral filaments; head fused with the first segment; thoracic segments armed with small spines on their posterior margins; urosome 3-segmented, the distal segment fused with the caudal rami; first antennae much longer than the body; both rami of the first legs 2-segmented, of the second, third, and fourth legs 3-segmented; fifth legs uniramose and 3-segmented.

KEY TO THE SPECIES (BOTH SEXES)

1. Anterior projection of head conical, entirely concealing the rostral filaments in dorsal view; fifth leg of female with one seta on second and three on third segment; right fifth leg of male tipped with a curved claw------------------------- **nasutus** (p. 34)

   Anterior projection of head anchor-shaped, leaving the rostral filaments visible dorsally; fifth leg of female with one seta on third segment and none on the second segment; right fifth leg of male with straight claw------------------------- **cornutus** (p. 35)

RHINCALANUS NASUTUS Giesbrecht

FIGURE 18

Rhincalanus nasutus GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 152, pls. 3, 9, 12, 35, 1892.—SARS, Crustacea of Norway, vol. 4, p. 15, pls. 6–7, 1901.

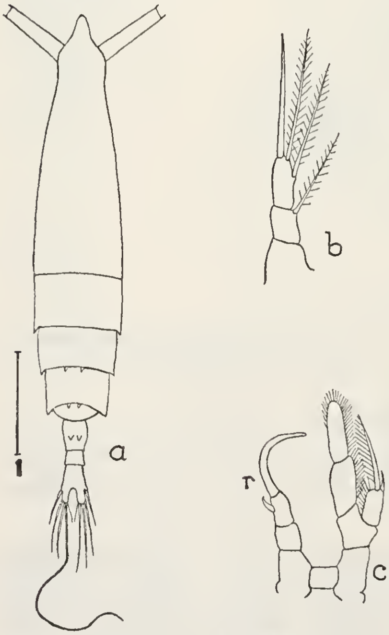

FIGURE 18.—*Rhincalanus nasutus: a*, Female, dorsal; *b*, fifth leg of female; *c*, fifth legs of male (*r*, right leg)

Occurrence.—Two females from trawl wings at Station 1032, *Fish Hawk;* 30 males and females from trawl wings at Stations 2173, 2195, 2219, *Albatross*, south and southeast of Nantucket.

Distribution.—Western Mediterranean, southern Pacific (Giesbrecht); northern Atlantic (Cleve); Iceland, North Sea (Sars); California coast (Esterly); Atlantic and Pacific Oceans (Giesbrecht); Indian Ocean (With); Chesapeake Bay (Wilson); Gulf of Maine (Bigelow).

Color.—Rathbun wrote concerning the two females taken at Station 1032, *Fish Hawk*, "The larger specimen with such extremely long antennae was absolutely colorless." Sars also said of this species in the reference quoted above, "Body highly pellucid, and almost without any pigment." On the colored plate of Giesbrecht's monograph (pl. 3, fig. 6), the ovary and oviducts have a whitish tint, there is a large spot of faint reddish yellow above the mouth, while the third, fourth, and fifth segments of the right antenna and the eye are bright ruby red. In the text Giesbrecht said that the red in the antenna was sometimes present on both sides, sometimes on one side only, and sometimes entirely lacking.

Female.—Body slender and elongated, the greatest width not exceeding a quarter of the length; the fused head and first segment nearly twice as long as the rest of the metasome; second, third, and fourth segments each with two small dorsal and two lateral spines on its posterior margin; genital segment with two similar dorsal spines near the middle of the segment; fifth legs with one seta on the second segment and three on the third segment, the outer one nonplumose and spiniform; caudal rami slightly asymmetrical. Total length, 4–5.5 mm.

Male.—Body similar to that of the female but the first antennae considerably shorter; left fifth leg biramose, endopod three times the length of the exopod and made up of two segments of about the same length; exopod 1-segmented, tipped with a long plumose seta and a much shorter nonplumose one outside of it. Right leg uniramose, tipped with a stout curved claw. Total length, 3–4 mm.

Remarks.—Although all Rathbun's specimens were obtained from the trawl wings, the species is also commonly found near the surface. It has come to be recognized as a regular factor in the fauna of the Woods Hole region, but apparently it is always rather scarce.

RHINCALANUS CORNUTUS Dana

FIGURE 19

Rhincalanus cornutus DANA, United States Exploring Expedition, 1838–1842 (Wilkes), vol. 14, Crustacea, p. 1083, 1853, pl. 77, fig. 2, 1855.—GIESBRECHT and SCHMEIL, Das Tierreich, Lief. 6, Copepoda, p. 23, 1898.

Occurrence.—Fifteen females from the trawl wings at Stations 2195, 2224, 2230, 2236, *Albatross*, south of Marthas Vineyard.

Distribution.—Gulf of Guinea, Sulu Sea (Dana); Canary Islands (Lubbock, Thompson); Philippines (Brady); tropical Atlantic and Pacific (Giesbrecht, Cleve, Dana); Malay Archipelago (Cleve); Gulf of Maine (Bigelow).

Color.—Entire body transparent and colorless except a vertical dash of reddish orange at the posterior margin of each segment on either side, and a crimson tinge at the base of the mouth parts. Eye spot elongate-oval, deep red, and rather minute.

Female.—Frontal projection of head anchor-shaped, the rostral filaments plainly visible in dorsal view; first antennae much longer than the body; each posterior corner of the second, third, and fused fourth and fifth segments armed with a stout spine, with two others on the dorsal surface, these spines increasing in size posteriorly; fifth legs without a seta on the second segment, and with a single one, stout and curved, on the inner margin of the third segment, distal to the center. Total length, 3.5–3.75 mm.

Male.—Right fifth leg uniramose, 3-segmented, and tipped with a nearly straight claw; left fifth leg biramose, endopod 2-segmented, the basal segment one-half longer than the terminal; exopod nearly as long as the endopod, 1-segmented, and tipped with a long, slender, and slightly curved claw. Total length, 2.5–2.75 mm.

Remarks. — Though this species has its center of distribution in the tropical portions of the large oceans, as noted by Bigelow, it does occur rather frequently within the present area, and has been found in considerable abundance at one or two stations off Marthas Vineyard. It can be recognized at once by the anchor-shaped frontal projection.

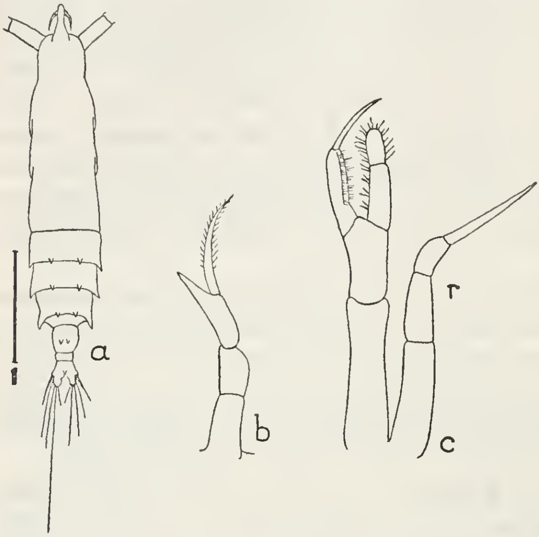

FIGURE 19.—*Rhincalanus cornutus: a,* Female, dorsal; *b,* fifth leg of female; *c,* male, fifth legs (*r,* right leg)

Genus MECYNOCERA Thompson, 1888

Head separated from the first segment; fifth segment with rounded posterior corners; first antennae more than twice as long as the entire body, with very long setae at the tip; urosome 3-segmented in the female, 4-segmented in male; none of the caudal setae elongated; exopod of second antenna half as long as endopod; exopods of first four pairs of legs 3-segmented, endopod of first pair 1-segmented, of the other three pairs 3-segmented; fifth legs uniramose, 5-segmented in both sexes. The genus contains but a single species.

MECYNOCERA CLAUSI I. C. Thompson

FIGURE 20

Mecynocera clausi THOMPSON, Journ. Linn. Soc. London, vol. 20, p. 150, pl. 11, 1888.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 160, pls. 5, 11, 35, 1892.

Occurrence.—Six females captured at the surface outside of Marthas Vineyard in the summer of 1915.

Distribution.—Canary Islands, Malta (Thompson); tropical Atlantic and Pacific (Giesbrecht, Cleve); Gulf Stream south of Marthas Vineyard (Wheeler, Sharpe); Indian Ocean (Thompson and Scott); Adriatic (Steuer); California coast (Esterly); Gulf of Guinea (T. Scott); North Sea (van Breeman).

Color.—Both sexes transparent and colorless except for a few small red spots irregularly arranged, which are sometimes present in various parts of the body and appendages. In exceptional cases the setae of the caudal rami and the first antennae are bright red; the eye spot is comparatively large and a deep ruby red.

Female.—Body elongate and slender, metasome nearly cylindrical, forehead somewhat angular; penultimate segment of fifth legs with a single seta, end segment with five setae. Total length, 1–1.15 mm.

Male.—Body and appendages, including the fifth legs, similar to those of the female but a little smaller; urosome, 4-segmented and wider than in the female. Fifth legs not modified for prehension. Total length, 0.75–0.9 mm.

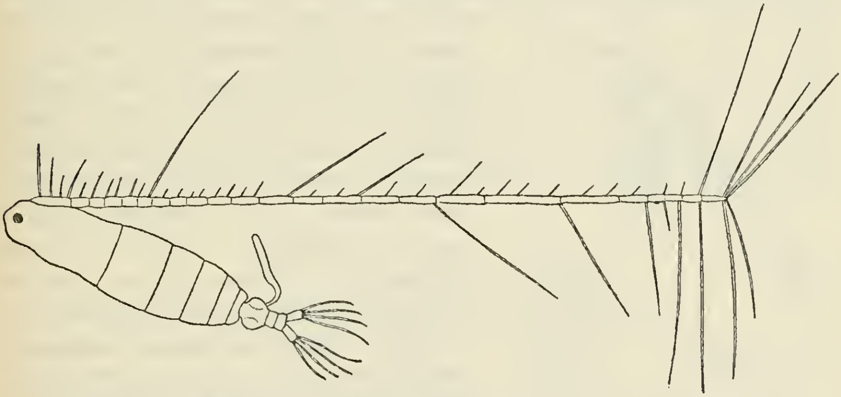

FIGURE 20.—*Mecynocera clausi:* Female, dorsal, (From W. M. Wheeler)

Remarks.—This species may be recognized by the exceptionally long first antennae and the comparatively small size of the copepod itself. By a curious mistake nearly every investigator since Thompson has reported the male as unknown, yet it is included in Thompson's original description and was more fully described and figured by T. Scott in 1894 in his report on the copepods of the Gulf of Guinea.

Family PARACALANIDAE

Genus PARACALANUS Boeck, 1865

Head fused with first segment and slightly carinated dorsally in the male; fifth segment with rounded posterior corners; urosome 4-segmented in female, 5-segmented in male; caudal rami short and obtuse; exopods of first 4 pairs of legs 3-segmented, endopods of first legs 2-segmented, of the other 3 pairs 3-segmented; fifth legs uniramose in both sexes. One species found here.

PARACALANUS PARVUS (Claus)

Figure 21

Calanus parvus Claus, Die frei lebenden Copepoden, p. 173, pl. 26, figs. 10–14, 1863.

Paracalanus parvus, Sars, Crustacea of Norway, vol. 4, p. 17, pls. 8, 9, 1901.

Occurrence.—Fifty males and females taken at the surface on Georges Bank, September 14 and 15, 1872; 40 males and females from trawl wings at Stations 2194, 2195, 2204, *Albatross*, southeast of Marthas Vineyard.

Distribution.—Helgoland (Claus); Mediterranean, Atlantic, and Pacific (Giesbrecht, Cleve); North Sea (Möbius, Bourne); Norwegian coast (Sars); Gulf of Guinea (T. Scott); Indian Ocean, Red Sea, Arabian Sea (Thompson and Scott); Malay Archipelago, Arabian Sea, Indian Ocean (Cleve); Skager Rak (Cleve); southern Pacific (A. Scott); Gulf stream south of Marthas Vineyard (Wheeler); Gulf of Maine (Bigelow); Woods Hole Harbor (Fish); Chesapeake Bay (Wilson).

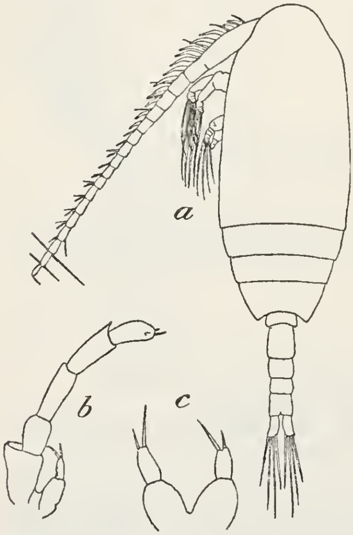

Figure 21.—*Paracalanus parvus: a,* Male, dorsal; *b,* fifth legs, male; *c,* fifth legs, female. (From W. M. Wheeler)

Color.—Body of female transparent, often with a bluish tinge, sometimes with a broad transverse band of red across the thorax, again with a variable extent of red pigment irregularly arranged. Male nearly always a uniform light yellow, sometimes with spots of red on the head and third thoracic segment.

Female.—Body short and stout; head evenly rounded anteriorly; rostrum with 2 weak filaments; first antennae reaching the abdomen; anterior and posterior surfaces of first basipod of each pair of legs armed with hairs and spinules; second segment of second and third endopods with an oblique row of spines on its posterior surface; fifth legs uniramose, 2-segmented, inner terminal seta as long as the distal segment. Total length, 0.75–1 mm.

Male.—Head thickened, with an obtuse keel along the dorsal surface; fifth segment rounded at posterior corners; genital segment very short; exopod of second antenna with only six segments; fifth legs uniramose, right one 2-segmented, left one 5-segmented, end segment shorter than either of the two preceding it, and tipped with two minute, unequal spinules. Total length, 0.9–1 mm.

Remarks.—This is one of our smallest calanoids, but it is widely distributed; it usually shows a decided preference for the surface but may be found at any depth, even at the bottom in deep water. Its small size would make it of little economic value in the food of adult fishes, but Bigelow has called attention to the fact that the large shoals found by the *Grampus* in the shallows off Marthas Vineyard may become of considerable importance in the diet of the young fishes that congregate there.

Genus CALOCALANUS Giesbrecht, 1888

Head usually fused with the first segment; fifth segment rounded posteriorly in the female, with sharp posterior corners in the male; urosome 2- or 3-segmented in the female, 5-segmented in male; caudal rami armed with beautiful plumose setae, greatly enlarged; first antennae reaching beyond the caudal rami, their basal segments with enlarged plumose setae; endopod of first legs 2-segmented, the other rami of the first four pairs of legs 3-segmented; fifth legs uniramose in both sexes.

KEY TO THE SPECIES (BOTH SEXES)

1. Body stout, three times as long as wide; caudal rami turned outward at right angles to the body axis, each with four equal plumes ---------- pavo (p. 39)
   Body slender, four times as long as wide; caudal rami only slightly divergent, inner plume of left ramus greatly enlarged ---------- plumulosus (p. 41)

CALOCALANUS PAVO (Dana)

FIGURE 22

Calanus pavo, DANA, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 13, 1849.
Calocalanus pavo GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 185, pls. 1, 4, 9, 36, 1892.

Occurrence.—Numerous females were found by Wheeler at the surface in the Gulf Stream south of Marthas Vineyard.

Distribution.—Cape Verde Island (Dana); tropical Atlantic and Pacific (Giesbrecht); Canary Islands, Malta (Thompson); northern Atlantic (Cleve); Adriatic (Steuer, Pesta); Mediterranean, Red Sea, Indian Ocean (Thompson and Scott); Woods Hole (Wheeler, Sharpe).

Color.—Female transparent, with large orange or brick-red spot in the posterior part of the thorax; the long bristles and the terminal segment of the first antennae are bright orange; the broad plumes at the base of the first antennae and on the caudal rami are brownish red, with a brilliant metallic iridescence; eye bright red. The body of the male is transparent, with a greenish-yellow wash; the terminal two-thirds of the first antennae and all their plumes, the long, narrow bristles of the second antennae, mandibles, and caudal rami are bright red; eye minute and ruby red.

Female.—Urosome 2-segmented; genital segment onion-shaped; caudal rami turned outward until they stand in the same straight line at right angles to the body axis; each ramus armed with four enlarged plumes, which can be spread or folded at will. Distal endopod segment of third and fourth legs with a cluster of small spines; fifth legs 4-segmented, the terminal segments with four or five plumose setae on the inner margin and at the tip and a single spine at the outer distal corner; this segment also has two rows of spinules across its anterior surface near the tip. Total length, 0.8–1.25 mm.

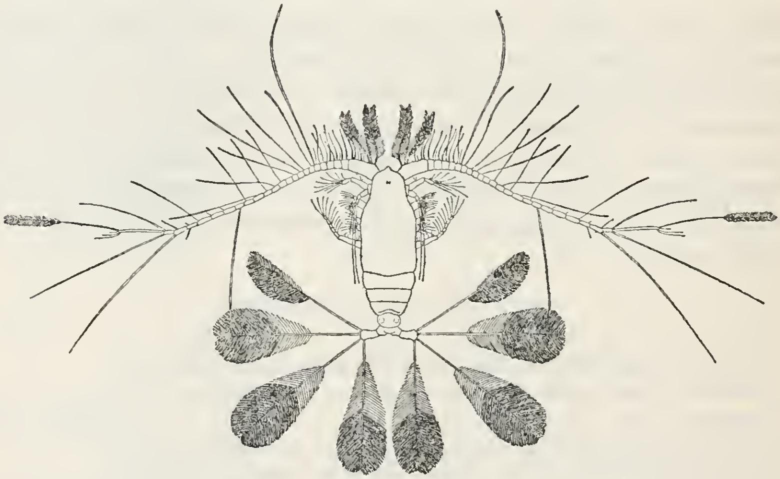

FIGURE 22.—*Calocalanus pavo:* Female, dorsal. (From W. M. Wheeler)

Male.—Head more or less separated from the first segment; fourth and fifth segments fused, with sharp posterior corners; urosome 5-segmented; caudal rami parallel with the body axis, the plumes slender and incapable of spreading or folding; right fifth leg 4-segmented, its tip only reaching the middle of the second segment of the left leg; the latter 5-segmented, a large spine at the inner distal corner of the fourth segment and two much smaller ones at the tip of the end segment. Total length, 1–1.15 mm.

Remarks.—In specimens obtained with a townet the large plumes on the caudal rami are always damaged and often entirely broken away. But even in this condition the copepod can be recognized by the peculiar position of the rami, and by the long bristles on the first antennae. It is a tropical species and was taken in considerable numbers by the present author at Montego Bay, Jamaica, in the summer of 1910.

CALOCALANUS PLUMULOSUS (Claus)

FIGURE 23

Calanus plumulosus CLAUS, Die frei lebenden Copepoden, p. 174, pl. 26, figs. 15, 16, 1863.

Calocalanus plumulosus GIESBRECHT and SCHMEIL, Das Tierreich, Lief. 6, Copepoda, p. 26, 1898.

Occurrence.—Several females were taken by Wheeler at the surface in the Gulf Stream south of Marthas Vineyard.

Distribution.—Messina (Claus); Mediterranean, tropical Atlantic and Pacific (Giesbrecht); Gulf Stream (Wheeler); Adriatic (Graeffe, Pesta).

Color.—Female transparent, with orange and red pigment scattered irregularly through the body, especially in the head, the fourth and fifth thoracic segments, and the genital segment, and along the sides of the thorax and abdomen. The two large plumes on the basal segments of the first antennae are dark brownish orange; the plumes on the caudal rami, including the enormously elongated one on the left ramus, are light reddish orange.

Female.—Segmentation indistinct; genital segment cuboidal; the left caudal ramus with an extra inner plume twice the width and five times the length of the entire body. Terminal endopod segment of third legs with two groups, of fourth legs with one group of spines; fifth legs much longer than in the preceding species, each 4-segmented, end segment tipped with a single long plumose seta and three spines, both margins and the inner margin of the preceding segment heavily fringed with long hairs. Total length, 0.9–1.25 mm.

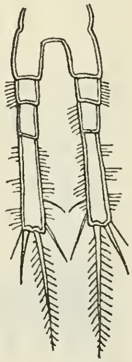

FIGURE 23.—*Calocalanus plumulosus*: Female, fifth legs

Male.—Unknown.

Remarks.—If specimens are obtained uninjured, the enormous plume on the left caudal ramus will at once identify the species. If this is broken off, the fifth legs furnish the best diagnostic characters. The antennae are considerably shorter than in *pavo*, and each has a single plume on the anterior margin of the basal segment. The caudal rami are much less divergent, and in preserved specimens the posterior body is usually bent back at right angles to the anterior body, as noted by Scott and Pesta.

Family PSEUDOCALANIDAE

Genus CLAUSOCALANUS Giesbrecht, 1888

Head fused with the first segment; fourth and fifth segments also fused, with rounded posterior corners; urosome 4-segmented; exopod of second antenna 6-segmented, longer than the endopod; first antennae just reaching the genital segment; exopods of the first four pairs of legs 3-segmented; first endopod 1-segmented, second endopod 2-segmented, third and fourth endopods 3-segmented; fifth legs uniramose, 3-segmented; basipods and exopods of second and third legs considerably wider than those of the fourth legs. One species.

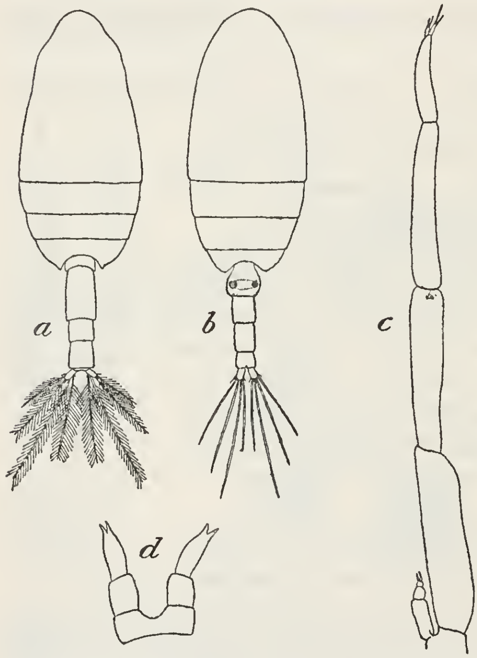

FIGURE 24.—*Clausocalanus arcuicornis: a,* Female, dorsal; *b,* male, dorsal; *c,* fifth legs, male; *d,* fifth legs, female. (From W. M. Wheeler)

CLAUSOCALANUS ARCUICORNIS (Dana)

FIGURE 24

Calanus arcuicornis DANA, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 12, 1849.

Clausocalanus arcuicornis GIESBRECHT and SCHMEIL, Das Tierreich, Lief. 6, Copepoda p. 27, 1898.

Occurrence.—Three males and numerous females were taken by Wheeler at the surface in the Gulf Stream south of Marthas Vineyard.

Distribution.—Messina (Claus); Mediterranean, tropical Atlantic and Pacific (Giesbrecht); Indian Ocean, Red Sea (Thompson and Scott); northern Atlantic (Cleve); Arabian Sea, Indian Ocean, Malay Archipelago (Cleve).

Color.—Not very transparent, with red pigment in some parts of the thoracic segments, on the dorsal and ventral surfaces, and in the genital segment. In the male the pigment is on the whole more abundant and may extend into the basal segments of the first antennae. In rare instances all the cuticle has a violet color; the eggs are rose colored (Wheeler).

Female.—Body elliptical in outline, widest at the center, narrowing equally in front and behind; genital segment longer than the first two abdominal segments combined; caudal rami as wide as long, each with four setae of about equal length. Total length, 1.15–1.6 mm.

Male.—Body oval in outline, widest posteriorly, narrowed much more in front than behind; first abdominal segment twice as long as the genital segment, and longer than the other two abdominal segments together; setae of caudal rami more unequal in length than in the female, the second inner one the longest. Total length, 1.1–1.2 mm.

Remarks.—Wheeler's specimens are the only ones thus far recorded from our American shores. The species is evidently a rare visitor here, but it will undoubtedly be found again within the limits of the present area.

Genus PSEUDOCALANUS Boeck, 1872

Body slender, head fused with the first segment; fifth segment with rounded posterior corners; urosome slender, 4-segmented in female, 5-segmented in male; first antennae reaching about the center of the abdomen; exopods of first 4 pairs of legs 3-segmented; first endopods 1-segmented, second endopods 2-segmented, third and fourth endopods 3-segmented; none of the legs widened or with spinules on the surface; fifth legs lacking in female, present in male. One species found here.

PSEUDOCALANUS MINUTUS (Krøyer)

FIGURE 25

Calanus minutus Krøyer, Naturh. Tidsskrift, ser. 2, vol. 2, p. 543, 1849.
Pseudocalanus minutus With, Danish *Ingolf*-Expedition, vol. 3, pt. 4, Copepoda 1, p. 57, pl. 1, fig. 8, 1915.

Occurrence.—Forty-five males and females from surface tow on Georges Bank, September 14, 1872; 1,000 males and females from Gulf of Maine, March and April, 1920, Stations 20062, 20069, 20077, 20108, *Grampus.*

Distribution.—Norwegian coast (Boeck, Sars); Shetland Islands (Norman); English Seas (T. Scott, Brady); Bohuslän (Trybom); Canary Islands, Malta (Thompson); North Sea (Möbius, Timm, Bourne); Helsingfors (Nordquist); Wimereux (Canu); Baltic Sea (Hensen); Greenland, Iceland, Faroe Islands (With); Alaska, Arctic Ocean (Willey, Mrázek); North Atlantic (Farran, Cleve); Kiehle Föhrde (Oberg, Giesbrecht); Adriatic (Pesta); Iceland (Paulsen); Mediterranean, Gulf of Suez (Thompson and Scott); Gulf of Maine (Bigelow); Chesapeake Bay (Wilson).

Color.—Body transparent; region around the vulva in the female bright green; the oil drops are an intense rusty red and are developed so numerously, especially in the male, that when there is a large assemblage of the copepods, as in a townet, they give a red color.

Female.—Anterior body elongate-elliptical in outline, nearly three times as long as wide; urosome half as long as metasome; genital segment enlarged and projecting ventrally; caudal rami longer than anal segment; fifth legs entirely lacking. Total length, 1.2–1.6 mm.

Male.—Much smaller than the female; urosome very narrow, with the anal segment shorter and dilated distally; fifth legs uniramose, asymmetrical, left leg 5-segmented, the second and third segments somewhat enlarged distally, the fifth segment very small and ending in a slender spine; right fifth leg 4-segmented, the segments diminishing in width distally, the fourth one virtually an acuminate spine. Total length, 1–1.25 mm.

Remarks.—After a careful examination of Krøyer's original type specimens, With has identified Krøyer's *minutus* with Boeck's *elongatus*, and since the former was described 20 years before the latter the species name given by Krøyer must be retained. This is apparently an arctic species, but extends southward on our Atlantic coast at least to latitude 35° N.

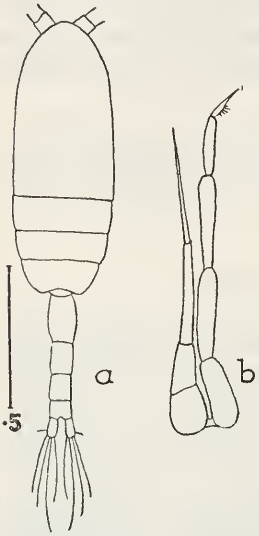

FIGURE 25.—*Pseudocalanus minutus: a*, Female, dorsal; *b*, fifth legs, male

Family AETIDEIDAE

Genus AETIDEUS Brady, 1883

Head in female highly vaulted anteriorly, slightly carinated dorsally, with a stout bifurcate rostrum; in the male less vaulted, not at all carinated, and entirely devoid of a rostrum. Fused fourth and fifth segments produced at the posterior corners into sharp spines, which reach beyond the posterior margin of the genital segment. Urosome 4-segmented in female, the genital segment protruding ventrally, 5-segmented in male, the genital segment not protruding, the anal segment very short. First antennae reaching the caudal rami in female, just reaching the genital segment in male. Fifth legs lacking in female; right fifth leg lacking in male, left uniramose, 5-segmented. One species found here.

AETIDEUS ARMATUS (Boeck)

FIGURE 26

Pseudocalanus armatus BOECK, Forh. Vid.-Selsk. Christiania, 1872, p. 38.
Aetideus armatus SARS, Crustacea of Norway, vol. 4, p. 25, pls. 13, 14, 1901.

Occurrence.—A single female in the trawl wings, Station 1039, *Fish Hawk;* 2 females in the trawl wings, Station 2195, *Albatross*, south of Nantucket.

Distribution.—Torres Strait (Brady); Gibraltar, tropical Pacific (Giesbrecht); Malta (Thompson); Mediterranean (Giesbrecht); North Sea, North Atlantic (Farran); Indian Ocean (Thompson and Scott); Adriatic (Steuer, Pesta); California coast (Esterly); Malay Archipelago (A. Scott); Gulf of Guinea (T. Scott); Gulf of Maine (Bigelow).

Color.—All the appendages and the caudal rami are transparent and colorless; the body is about half transparent and the other half orange or blood red. Through the long cephalothorax the band of red is quite intense; the posterior segments are all red, but the color is weak except at the joints, where it is intense and deep. There is a small red dot on each side where the first antenna joins the head (Rathbun).

Female.—Metasome elongate-elliptical, width a little more than a third of the length; caudal rami about three times as long as wide, considerably longer than the anal segment, finely ciliated on their inner margins; a long nonplumose seta on the dorsal surface of each ramus near the distal end. Total length, 1.8 mm.

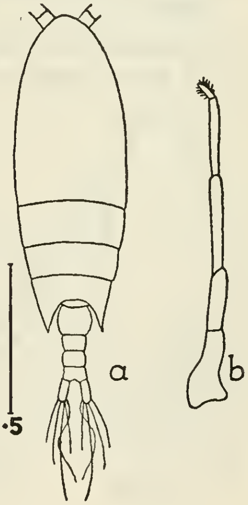

FIGURE 26.—*Aetideus armatus: a,* Female, dorsal; *b,* fifth leg, male. (After Sars)

Male.—Smaller and more slender than the female, the head considerably narrowed anteriorly and devoid of a rostrum. Spines at posterior corners of fifth segment smaller and shorter than in the female. Left fifth leg nearly as long as the urosome, the third segment the longest, the end segment slender and fringed with fine cilia. Total length, 1.25–1.45 mm.

Remarks.—The female can be recognized by the highly vaulted forehead and the coarse spines at the posterior corners of the fifth segment; the most distinctive character of the male is the single left fifth leg, with its five segments.

Genus AETIDEOPSIS G. O. Sars, 1903

Anterior portion of head much narrowed, with the frontal margin flattened on each side; fifth segment distinctly separated from the fourth, its posterior corners produced into slender spines, which scarcely reach the center of the genital segment; urosome 4-segmented. Exopods of first four pairs of legs 3-segmented; first endopod 1-segmented, second endopod 2-segmented, third and fourth endopods 3-segmented; fifth legs lacking in female, male unknown. One species found here.

AETIDEOPSIS ROSTRATA G. O. Sars

FIGURE 27

Aetideopsis rostrata SARS, Crustacea of Norway, vol. 4, p. 160, suppl. pls. 4, 5, 1903.

Occurrence.—A single female from the trawl wings, Station 1089, *Fish Hawk*, northeast of Cape Cod Light.

Distribution.—Between Jan Mayen and Finmark (Sars); North Sea (Wolfenden); west coast of Ireland (Farran); Arctic Ocean (Koefoed and Damas); between Iceland and Greenland (With); Malaysia (A. Scott).

Color.—Sars made the statement: "Color not yet ascertained," and this is still true, since Rathbun made no notes on this single specimen.

Female.—Body elongate-obovate; anterior head widened through the mouth and abruptly narrowed in front of this, the forehead triangular. First antennae reaching posterior margin of first abdominal segment; urosome one-third as long as metasome; genital segment protruding slightly ventrally. Apical spines on the exopods of the first four pairs of legs densely pectinated. Total length, 4.4 mm.

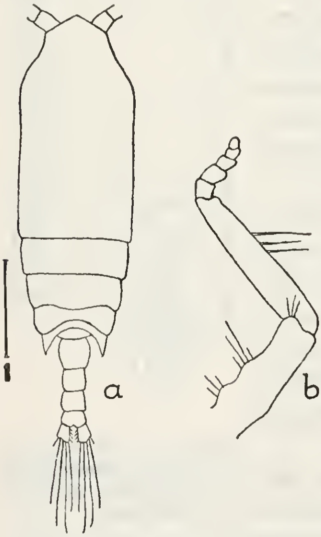

FIGURE 27.—*Aetideopsis rostrata:* *a*, Female, dorsal; *b*, maxilliped. (After Sars)

Male.—Unknown.

Remarks.—The distinct separation of the fourth and fifth segments and the much shorter spines at the posterior corners of the latter distinguish this genus from *Aetideus*. It has never before been reported from the American coast.

Genus CHIRIDIUS Giesbrecht, 1892

Head narrowed anteriorly; fourth and fifth segments completely fused, with slender and sharp spines at the posterior corners. Urosome 4-segmented in female, 5-segmented in male; caudal rami nearly as wide as long; appendicular bristles short and on the ventral surface. Exopods of first four pairs of legs 3-segmented; first endopods 1-segmented, second endopods 2-segmented, third and fourth endopods 3-segmented; fifth legs lacking in female, uniramose and 5-segmented in male, often with the rudiment of an endopod. One species found here.

CHIRIDIUS ARMATUS (Boeck)

FIGURE 28

Euchaeta armata BOECK, Forh. Vid.-Selsk. Christiania, 1872, p. 39.
Chiridius armatus SARS, Crustacea of Norway, vol. 4, p. 27, pls. 15, 16, 1901.

Occurrence.—One male from trawl wings, Station 2230, *Fish Hawk;* 12 males and females in a vertical haul, Station 20077, *Grampus*, east of Cape Cod.

Distribution.—Norwegian coast and fiords (Boeck, Sars); North Atlantic (Cleve); British seas (T. Scott); North Sea (Damas and Koefoed); Greenland (Vanhöffen).

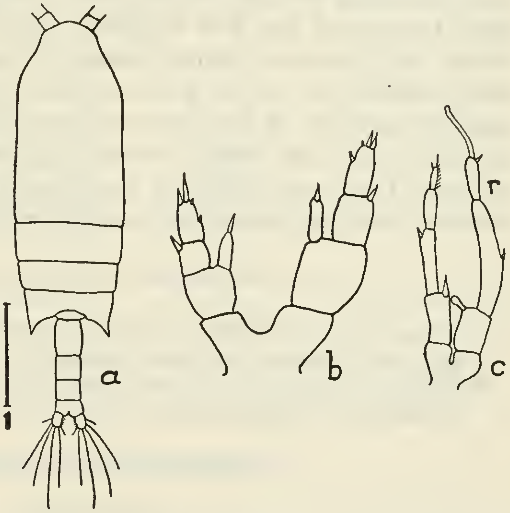

FIGURE 28.—*Chiridius armatus: a*, Female, dorsal (after Sars); *b*, fifth legs, young male; *c*, fifth legs, adult male (*r*, right leg)

Color.—Body transparent and colorless, with a faint wash of rosy red; intestine in the female bright carmine, in the male much duller and more of a brick red; ovaries and oviducts opaque white; eye dark ruby red (Rathbun).

Female.—Metasome nearly three times as long as wide, the spines on the posterior corners of the fifth segment short and somewhat divergent. Head with a very small bifid rostrum; first antennae reaching the first abdominal segment; caudal rami no longer than the anal segment, and a little divergent; exopod of second antennae 7-segmented and one-third longer than the endopod. Total length, 4 mm.

Male.—Nearly as long as the female but more slender; spines at posterior corners of fifth segment very small and mucronate; fifth legs 5-segmented, right leg stouter than left, both legs with tiny rudiments of an endopod on the inner margin of the second segment at the distal corner. Total length, 4 mm.

Remarks.—According to Sars this species on the Norwegian coast is a deep-water form, but he considered it probable that in more northern latitudes it may ascend nearer to the surface. It is worthy of note that 3 females of the species *Chiridius obtusifrons* were obtained by the *Grampus* at Station 20075, south of Cape Sable, Nova Scotia. This is not within the present area, but is so close to it that the species is likely to be found here at some future time.

Genus CHIRUNDINA Giesbrecht, 1895

Body elongate and rather slender, considerably narrowed anteriorly; forehead with or without crest; rostrum short and undivided; head fused with the first segment; fourth and fifth segments also fused, the posterior corners sharp in the female, rounded in the male; exopod of second antenna twice as long as endopod, 7-segmented; exopods of first four pairs of legs 3-segmented, except in the first legs of the female, where it is sometimes 2-segmented; first endopod 1-segmented, second 2-segmented, third and fourth 3-segmented; fifth legs lacking in female, present in male.

KEY TO THE SPECIES (BOTH SEXES)

1. Forehead with crest; genital segment symmetrical; exopod of first legs in female with only 2 segments________________ **streetsii** (p. 48)
   Forehead without crest; genital segment asymmetrical; exopod of first legs in female with 3 segments________________ **pustulifera** (p. 49)

CHIRUNDINA STREETSII Giesbrecht

Figure 29

Chirundina streetsii Giesbrecht, Bull. Mus. Comp. Zool., vol. 25, no. 12, p. 249, pl. 1, figs. 5–10, 1895.—Giesbrecht and Schmeil, Das Tierreich, Lief. 6, Copepoda, p. 34, 1898.

Occurrence.—Two females from trawl wings, Station 1039, *Fish Hawk;* 2 females in a vertical haul, Station 20045, *Grampus*, south of Georges Bank.

Distribution.—South of Iceland (With); northeastern Atlantic (Farran); Malay Archipelago (A. Scott); South Atlantic, off Africa (Cleve, Stebbing); California coast (Esterly); Gulf of Maine (Bigelow).

Color.—The only statement in regard to the color of this species was made by Esterly, who said that it is " whitish in formalin but without pigment."

Female.—Forehead with a crest; posterior corners of fifth segment produced into short and rather blunt spines; urosome 4-segmented; genital segment symmetrical and protruding ventrally; caudal rami nearly twice as wide as long, with dense tufts of fine hairs on their inner margins; exopod of first leg 2-segmented, the 2 proximal segments fused; first basipod of fourth legs without spines on the inner margin. Total length, 5–5.3 mm.

Male.—Forehead with a crest; posterior corners of fifth segment smoothly rounded; exopod of first leg 3-segmented; fifth legs biramose, exopods 3-segmented, endopods 1-segmented; right endopod club-shaped, not reaching the distal margin of the first segment of the exopod; left endopod reaching beyond the distal margin of the first segment of the exopod, curved and tapered to a sharp point. Total length, 4–4.3 mm.

Remarks.—Rathbun's specimens were mixed with another species and probably escaped notice; this is unfortunate since it leaves the color of the species still unknown.

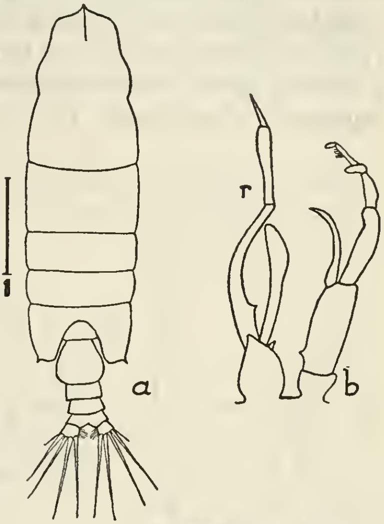

FIGURE 29.—*Chirundina streetsii: a,* Female, dorsal; *b,* fifth legs, adult male (after Esterly)

CHIRUNDINA PUSTULIFERA (G. O. Sars)

FIGURE 30

Undeuchaeta pustulifera SARS, Bull. Mus. Océanogr. Monaco, no. 26, p. 14, 1905.
Chirundina pustulifera WITH, Danish *Ingolf*-Expedition, vol. 3, pt. 4, Copepoda 1, p. 145, pl. 5, figs. 6, a–d, text fig. 39, 1915.

Occurrence.—A single male from the trawl wings, Station 2195, *Albatross*, south of Nantucket.

Distribution.—North Atlantic, Irish coast (Farran); between British Isles and Iceland (With); Atlantic, Monaco Expedition (Sars).

Color.—Nothing is known of the color when alive; preserved specimens are a light grayish brown.

Female.—Forehead without a crest; posterior corners of fifth segment rounded, without spines; urosome 4-segmented; genital segment asymmetrical, with protuberances on each side and the ventral surface; caudal rami twice as wide as long, with a dense fringe of hairs on their inner margins; exopod of first leg 3-segmented; basipod of fourth leg with a process on the inner margin armed with stout spines. Total length, 6.9 mm.

Male.—Forehead without a crest; urosome only one-fourth as long as metasome; anal segment very short; genital segment symmetrical, without protuberances; first 4 pairs of legs, like those of female; fifth legs biramose, endopods 1-segmented, exopods 3-segmented, the right one tipped with a very long and slender spine, the left one with a minute spine; neither endopod reaches the distal end of the first segment of the exopod. Total length, 6.5 mm.

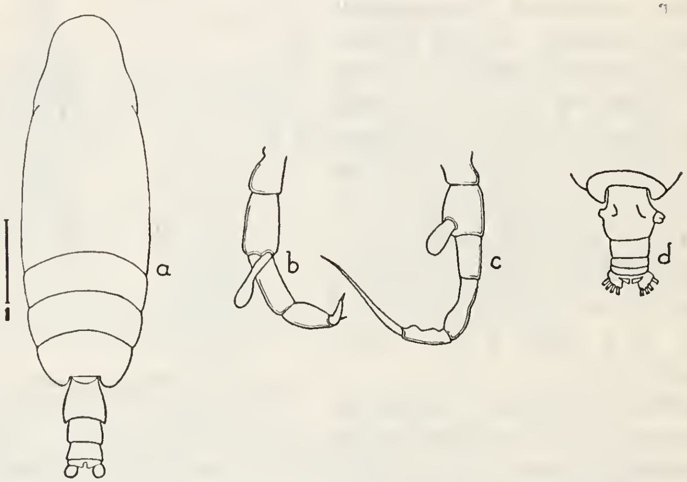

FIGURE 30.—*Chirundina pustulifera: a,* Male, dorsal; *b,* left, and *c,* right fifth leg of male; *d,* female urosome, dorsal (after Giesbrecht)

Remarks.—With, in the reference cited above, has given valid reasons for referring this species to the genus *Chirundina,* and the present specimen belongs to that genus rather than to *Undeuchaeta,* as is shown by its fifth legs. This is the first record of the species from American shores.

Genus GAETANUS Giesbrecht, 1888

Head fused with the first segment and carrying on its dorsal surface at the anterior end a median spine; fourth and fifth segments fused, with sharp spines at the posterior corners in the female, smoothly rounded in the male; urosome 4-segmented; exopod of first legs 2- or 3-segmented, of the three following pairs 3-segmented; endopod of first leg 1-segmented, of second leg 2-segmented, of third and fourth legs 3-segmented; fifth legs lacking in female, present in the male, each 5-segmented, with rudimentary endopod.

KEY TO THE SPECIES (BOTH SEXES)

1. First antennae twice as long as body; spine on head pointed forward; exopod of first legs 2-segmented________________ **miles** (p. 51)
   First antennae reaching little beyond caudal rami; spine on head pointed ventrally; exopod of first legs 3-segmented__ **kruppii** (p. 52)

GAETANUS MILES Giesbrecht

FIGURE 31

Gaetanus miles GIESBRECHT, Atti Accad. Lincei, Rome, ser. 4, vol. 4, sem. 2, p. 335, 1888; Fauna und Flora des Golfes von Neapel, vol. 19, p. 219, pls. 14, 36, 1892.

Occurrence.—A single female taken in a vertical haul, Station 20069, *Grampus*, south of Georges Bank.

Distribution.—North Atlantic (Farran); tropical Pacific (Giesbrecht); Malay Archipelago (A. Scott); between British Isles and Iceland (With); South Atlantic (Cleve, Stebbing); Gulf of Maine (Bigelow).

Color.—Nothing is known with regard to the color of the living copepod; preserved specimens are quite transparent and yellowish horn-color.

Female.—Spine on the head pointing straight forward; first antennae more than twice the body length; spines at posterior corners of fifth segment almost reaching the posterior margin of the genital segment; exopod of first legs with only 2 segments; inner margin of basipod of fourth leg with a semicircular row of 5 or 6 coarse setae or spines. Total length, 3–4.3 mm.

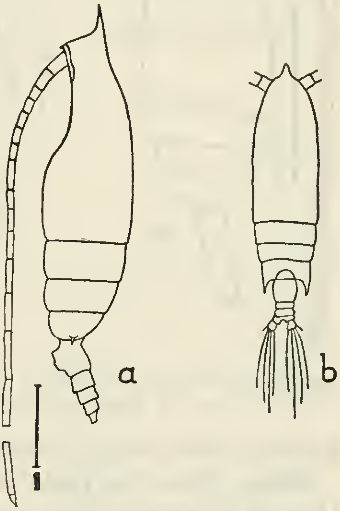

FIGURE 31.—*Gaetanus miles*, female: *a*, Lateral; *b*, dorsal

Male.—Unknown.

Remarks.—This species may be recognized by the length of the first antennae and the presence of a frontal spine. The number of spines on the fourth basipod seems to be larger in Pacific than in Atlantic specimens. Although widely distributed it is found nowhere in any abundance.

GAETANUS KRUPPII Giesbrecht

FIGURE 32

Gaetanus kruppii GIESBRECHT, Mittheil. Zool. Stat. Neapel, vol. 16, p. 202, pl. 7, fig. 8, pl. 8, fig. 29, 1903.—VAN BREEMEN, Nordisches Plankton, Zoologischer Teil, vol. 4, Entomostraca, Copepoden, p. 41, fig. 47, 1908.

Occurrence.—A male and female from the trawl wings, Station 2195, *Albatross*, south of Nantucket.

Distribution.—Mediterranean (Giesbrecht); North and South Atlantic (Farran); Denmark Strait, Iceland, Faroe Islands (With); Malay Archipelago (A. Scott); Indian Ocean (Thompson).

Color.—Body a uniform bright carmine red, yellowish along the grooves between the segments; plume on the basal half of the first antennae orange; setae on the antennae, mouth parts, and caudal rami blue (Giesbrecht).

Female.—Larger than the preceding species; frontal spine pointing ventrally; spines at posterior corners of fifth segment mucronate and not reaching center of genital segment; first antennae reaching only three segments beyond the caudal rami; inner distal corner of fourth basipod with 25 to 30 stiff bristles chiefly on the posterior surface. Total length, 3.6–4.5 mm.

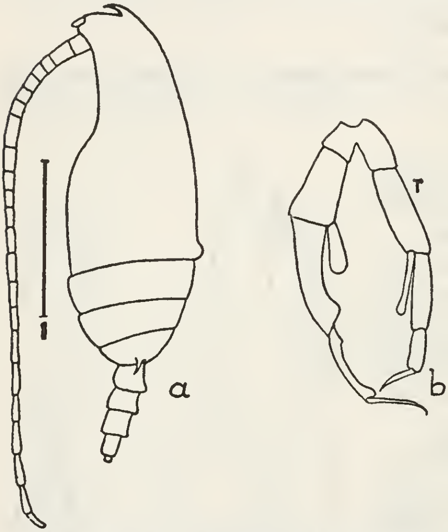

FIGURE 32,—*Gaetanus kruppii: a,* Female, lateral; *b,* male, fifth legs

Male.—Spines at posterior corners of fifth segment much shorter than in the female; anal segment also much shortened; first antennae not reaching the caudal rami, their basal half with numerous short colored aesthetasks on the anterior margins; no bristles on the fourth basipods; fifth legs biramose, endopods 1-segmented, right exopod 2 or 3 segmented, left exopod 3-segmented. Total length, 3.7–5 mm.

Remarks.—This is a deep-water species and rather widely distributed, but it has never before been reported from our American coasts. It may be distinguished from the preceding species by the fact that the frontal spine is turned ventrally at right angles to the body axis.

Genus GAIDIUS Giesbrecht, 1895

Head fused with the first segment; fourth and fifth segments also fused, with spines at the posterior corners; urosome 4-segmented in female, 5-segmented in male; caudal rami short, with fine hairs on their inner margins; first antennae slender and not as long as the body; exopods of first four pairs of legs 3-segmented; first endopod 1-segmented, second 2-segmented, third and fourth 3-segmented; fifth legs lacking in female, present and biramose in male.

KEY TO THE SPECIES (BOTH SEXES)

1. First antennae reaching the first abdominal segment; spines at posterior corners of fifth segment slender and nearly as long as genital segment---------------------------------- tenuispinus (p. 53)
   First antennae reaching tip of caudal rami; spines at posterior corners of fifth segment small and scarcely visible--- brevispinus (p. 54)

GAIDIUS TENUISPINUS (G. O. Sars)

FIGURE 33

Chiridius tenuispinus SARS, Norwegian North Polar Expedition, 1893–1896, vol. 1, no. 5, Crustacea, p. 67, pl. 18, 1900.
Gaidius tenuispinus SARS, Crustacea of Norway, vol. 4, p. 162, pl. 18, 1903.

Occurrence.—Two females from trawl wings, Station 994, *Fish Hawk;* 5 females from trawl wings, Stations 2093, 2195, 2230, *Albatross*, south of Marthas Vineyard.

Distribution.—Polar seas, Norwegian coast (Sars); North Atlantic (Farran); California coast (Esterly); Arctic Ocean (Mrázek); Faroe Channel, Antarctic Ocean (Wolfenden); English seas (Pearson, T. Scott); Greenland (Vanhöffen, Damas); North Sea (van Breemen); Davis Strait, Denmark Strait, Iceland (With); Gulf of Maine (Bigelow).

Color.—Body translucent and whitish, with a large red spot near the anterior margin of the head (Rathbun).

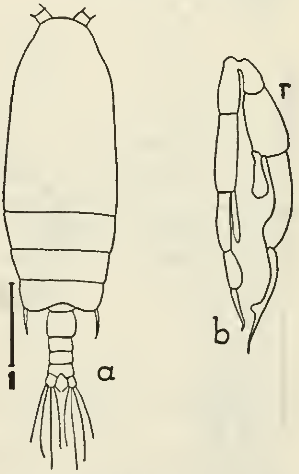

FIGURE 33.—*Gaidius tenuispinus*: *a*, Female, dorsal; *b*, male, fifth legs (*r*, right leg)

Female.—Spines at posterior corners of fifth segment slender, nearly straight, and about as long as the genital segment; urosome one-fourth as long as metasome; genital segment protruding ventrally; caudal rami slightly longer than wide, rounded at their tips, the two proximal segments of first legs fused, without an outer spine. Total length, 3.5–3.8 mm.

Male.—Spines at posterior corners of fifth segment reaching beyond the distal margin of the genital segment; urosome slender and more than one-third as long as metasome; anal segment almost obsolete; first antennae considerably dilated basally and densely fringed with large curved aesthetasks; two proximal segments of first exopods distinctly separated; fifth legs large, biramose and asymmetrical; endopods 1-segmented, right club-shaped, left longer and much narrower; right exopod 2-segmented, left 3-segmented, end segment spiniform. Total length, 2–2.25 mm.

Remarks.—With designated this species as a North Atlantic and arctic form, frequenting the intermedial layers. All the present specimens came from the trawl wings, which suggests that as the species comes farther south and nearer the shore it seeks the colder water near the bottom.

GAIDIUS BREVISPINUS (G. O. Sars)

FIGURE 34

Chiridius brevispinus SARS, Norwegian North Polar Expedition, 1893–1896, vol. 1, no. 5, Crustacea, p. 68, pl. 19, figs. 1–11, 1900.

Gaidius brevispinus SARS, Crustacea of Norway, vol. 4, p. 162, suppl. pl. 6, 1903.

Occurrence.—One male from trawl wings, Station 2219, *Albatross;* 1 female from trawl wings, Station 2236, *Albatross*, off Marthas Vineyard.

Distribution.—Polar Basin (Sars); Faroe Channel (Norman); Denmark Strait, Iceland (With); Arctic Ocean (Mrázek); North Atlantic (Farran); North Sea (van Breemen); English seas (Pearson); Gulf of Maine (Bigelow).

Color.—No statement regarding color has yet appeared.

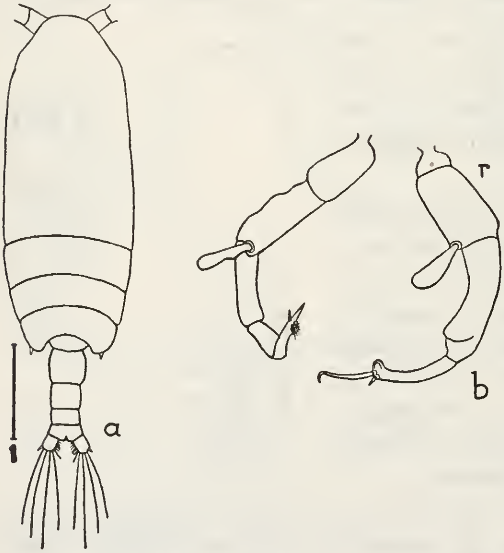

FIGURE 34.—*Gaidius brevispinus: a,* Female, dorsal; *b,* fifth legs of male (*r,* right leg)

Female.—Spines at posterior corners of fifth segment pointed diagonally downward; urosome one-third as long as metasome; genital segment flattened ventrally; caudal rami divergent; two proximal segments of first exopod separated, but the basal segment has no outer spine. Total length, 3.9–4.8 mm.

Male.—Considerably smaller than female; spines at posterior corners of fifth segment smaller and shorter; two proximal segments of first exopod separated, neither of them with outer spine; fifth legs biramose, asymmetrical; endopods 1-segmented, club-shaped, exopods 3-segmented, end segment of left one enlarged near the tip and armed with stiff hairs and a spine. Total length, 3.01–3.35 mm.

Remarks.—This species is larger than the preceding one and differs further in the size of the spines at the corners of the fifth segment and in the form of the fifth legs of the male. It also is boreal and pelagic and seems to seek the colder water near the bottom.

Genus EUCHIRELLA Giesbrecht, 1888

Head usually separated from first segment, with or without a crest; posterior corners of fifth segment rounded; urosome 4-segmented in female, 5-segmented in male; caudal rami about as wide as long, each with a dense tuft of long fine hairs on the inner margin; exopod of first leg 2-segmented, of the three following pairs 3-segmented; endopod of first and second legs 1-segmented, of third and fourth legs 3-segmented; basipod of fourth legs in female with spines on inner margin and posterior surface; fifth legs lacking in female, present and biramose in male.

KEY TO THE SPECIES (BOTH SEXES)

1. Forehead without a crest____ 2
   Forehead with a crest____ 3
2. Exopod of second antenna twice as long as endopod, or less_ **rostrata** (p. 55)
   Exopod of second antenna four times as long as endopod_ **messinensis** (p. 56)
3. Exopod of second antenna two and a half times as long as the endopod, or less ____ **pulchra** (p. 58)
   Exopod of second antenna four times as long as endopod_ **curticauda** (p. 59)

EUCHIRELLA ROSTRATA (Claus)

FIGURE 35

Undina rostrata CLAUS, Die Copepodenfauna von Nizza, p. 11, pl. 1, fig. 2, 1866.
Euchirella rostrata GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 232, pls. 2, 15, 1892.

Occurrence.—Four males and females from trawl wings, Stations 2195, 2219, 2230, *Albatross;* two females in vertical haul, Station 10295, *Grampus*; the former south of Nantucket.

Distribution.—Mediterranean (Giesbrecht); California coast (Esterly); northern Atlantic (Cleve); Indian Ocean (Thompson); Greenland, Iceland, Faroe Channel (With); southern Pacific (Brady); Canary Islands (Cleve).

Color.—Not very transparent; red pigment scattered through the body, especially along the midline, on the posterior margins of the thoracic segments, and in the genital segment. The long plumose setae on the exopods of the second antennae are reddish yellow and the same color is found in the basipods of the legs.

Female.—Forehead without a crest but with a rostrum; urosome symmetrical; genital segment as long as the three abdominal segments combined; caudal rami as wide as long, quite divergent, with tufts of hairs on their inner margins; distal segment of endopod of second antenna with eight and six setae; basipod of fourth leg with a row of six or seven flattened spines on the posterior surface. Total length, 2.75–3.25 mm.

Male.—Forehead like that of female; body considerably smaller; genital segment not protruding ventrally; fifth legs biramose, endopods 1-segmented, right exopod 2-segmented, left 3-segmented; inner margin of right exopod smooth and unarmed.

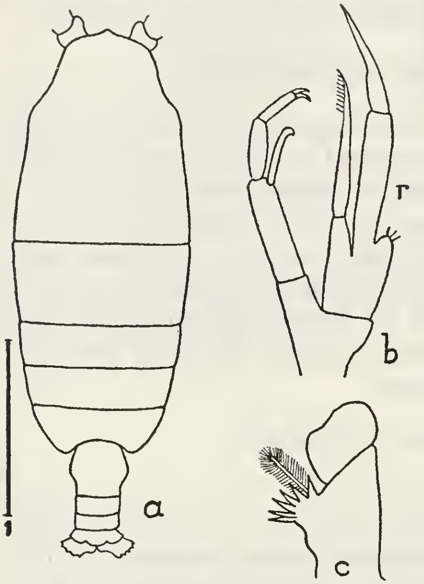

FIGURE 35.—*Euchirella rostrata: a,* Female, dorsal; *b,* male, fifth legs (*r,* right leg); *c,* female, basipod of fourth leg

Remarks.—Cleve has shown in his discussion of the plankton of the North Sea, the English Channel, and the Skager Rak[5] that Brady's *Euchaeta hessei* is really the male of the present species. It probably enters the Woods Hole area as a visitor from considerable depths along the edge of the Gulf Stream, since the specimens here recorded were taken at a depth of 1,000 fathoms. Bigelow says that apparently it does not enter the Gulf of Maine except during the warmer summer months.

EUCHIRELLA MESSINENSIS (Claus)

FIGURE 36

Undina messinensis CLAUS, Die frei lebenden Copepoden, p. 187, pl. 31, figs. 8–18, 1863.

Euchirella messinensis GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 232, pls. 15, 36, 1892.

Occurrence.—One female from trawl wings, Station 994, *Fish Hawk;* one female from trawl wings, Station 2093, *Albatross*, south of Marthas Vineyard.

Distribution.—Messina (Claus); Mediterranean (Giesbrecht); Gulf of Guinea (T. Scott); Indian Ocean (Thompson and Scott); west coast of Ireland (Farran); Adriatic (Pesta); California coast (Esterly); Malay Archipelago (A. Scott); North Sea (With).

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[5] Svenska Akad. Handl., vol. 33, p. 4, pl. 2, figs. 1–2, 1900.

Color.—General body color reddish and not very transparent; the red pigment is distributed very unevenly and is most dense along the midline of the dorsal surface, on the posterior margins of the thoracic segments, especially at the sides of the body, on the dorsal surface of the genital segments, on the long plumose setae of the second antennae, and on the proximal segments of the mouth parts. The first antennae, the second pair all except the setae, the distal portions of the mouth parts, the abdomen, and the caudal rami are colorless (Rathbun).

Female.—Forehead without a crest but with a rostrum; urosome one-fifth as long as metasome; genital segment asymmetrical with a sack-shaped protuberance on the dorsal surface at the left of the midline; second outer seta on the right caudal ramus as long as the body; exopod of second antenna four times as long as endopod; end segment of endopod with five and four setae; basipod of fourth leg with only one or two spines on inner margin. Total length, 4.5–5 mm.

Male.—Forehead with a low crest and with a rostrum; urosome one-fourth as long as metasome and symmetrical; no elongated seta on caudal rami; fifth legs biramose, endopods 1-segmented, the left one very rudimentary, possibly sometimes lacking; left exopod 3-segmented, rodlike, right exopod 2-segmented, end segment with a row of sawteeth on the inner margin. Total length, 3.75–4 mm.

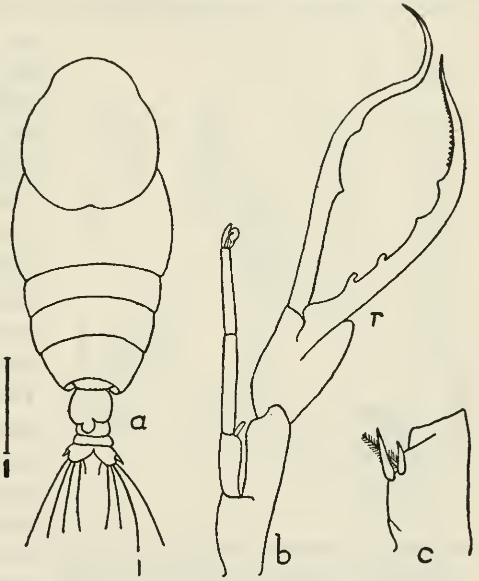

FIGURE 36.—*Euchirella messinensis: a,* Female, dorsal; *b,* male, fifth legs (*r,* right leg); *c,* basipod of fourth leg of female (*b, c,* after Giesbrecht)

Remarks.—The female of this species is distinguished by the sack-shaped appendage on the genital segment and the length of the exopod of the second antenna. The male can be told by the structure of the fifth legs. It has never before been reported from the American side of the North Atlantic.

EUCHIRELLA PULCHRA (Lubbock)

Figure 37

Undina pulchra Lubbock, Trans. Ent. Soc. London, new ser., vol. 4, p. 26, pl. 4, figs. 5–8, pl. 7, fig. 6, 1856.

Euchirella pulchra Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, p. 233, pls. 15, 36, 1892.

Occurrence.—Three females in a vertical haul, Station 20044, *Grampus*, south of Georges Bank.

Distribution.—Tropical Atlantic and Pacific (Giesbrecht, Brady); Gulf of Guinea (Lubbock); Abrolhos, Australia, Caldera, Chile (Giesbrecht); California coast (Esterly); North Atlantic (Brady); Gulf of Maine (Bigelow).

Color.—Body somewhat opaque, with red pigment above the mouth parts, along the median axis, and on the basipods of the swimming legs. The densely plumose setae of the second antennae are also pinkish or reddish and stand out conspicuously as in other species of the genus.

Female.—Forehead with a low crest and a small rostrum; urosome about one-fourth as long as metasome; genital segment asymmetrical, with a stout protuberance on the left side of the dorsal surface and an indentation on the right side; exopod of second antenna two and one-half times as long as endopod; end segment of the latter with six and five setae; basipod of fourth leg with one or two spines on its inner margin. Total length, 3.4–4.4 mm.

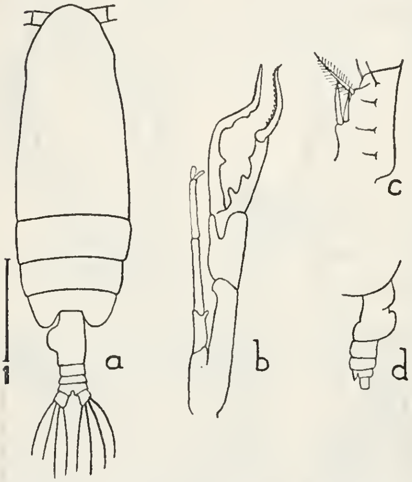

Figure 37.—*Euchirella pulchra: a,* Female, dorsal (after Sars); *b,* male, fifth legs; *c,* female, basipod of fourth leg; *d,* urosome, lateral (*b, c, d* after Giesbrecht)

Male.—Forehead with a crest and a rostrum; urosome symmetrical; anal segment very short and divided at the center so as to cause the caudal rami to appear 2-segmented; fifth legs biramose, left endopod so rudimentary as to be easily overlooked; chela on right leg shorter than the basipod; right exopod 2-segmented, proximal segment with three angular protuberances on inner margin, distal segment with a series of fine tubercles. Total length, 3.5–3.75 mm.

Remarks.—This species may be distinguished by the presence of a crest and by the relative lengths of the rami of the second antennae in the female, and in the male by the fact that the chela of the right fifth leg is shorter than the basipods. This species prefers the open ocean and is not likely to be found in shallow water along the shore.

EUCHIRELLA CURTICAUDA Giesbrecht

FIGURE 38

Euchirella curticauda GIESBRECHT, Atti Accad. Lincei, Rome, ser. 4, vol. 4, p. 336, 1888.

Occurrence.—There is as yet no record of this species within the present area, but both sexes have been captured so close at hand that it is likely to appear at any time in the future.

Distribution.—North Pacific (Giesbrecht); North Atlantic (Wolfenden, Farran); Malay Archipelago (A. Scott); California coast (Esterly); North Sea (van Breemen); Denmark Strait, Faroe Channel, Iceland (With); Gulf of Maine (Bigelow).

Color.—Body fairly transparent, with red pigment scattered along the dorsal midline, on the basipods of the swimming legs, and in the plumose setae of the second antennae, as in the other species.

Female.—Forehead with a high crest, but with only a vestige of a rostrum; urosome less than one-sixth as long as metasome and perfectly symmetrical; genital segment protruding ventrally; none of the caudal setae elongated; exopod of second antennae four times as long as endopod; end segment of latter with 3 and 2 setae; basipod of fourth leg with a row of 12 or 13 spines running from the inner margin along the posterior surface. Total length, 2.5–4.8 mm.

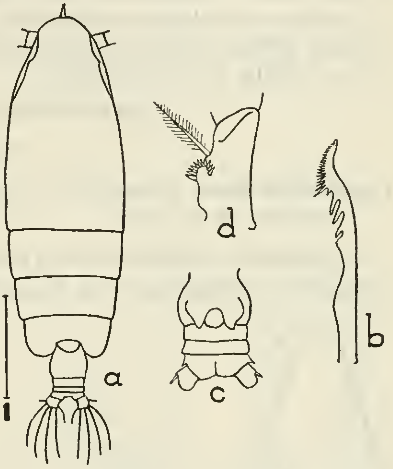

FIGURE 38.—*Euchirella curticauda: a,* Female, dorsal (after Sars); *b,* male, last segment of right fifth exopod; *c,* urosome, ventral; *d,* female, fourth basipod (*b, c, d,* after Giesbrecht)

Male.—Forehead with a crest, without a rostrum; first antennae extending little beyond the cephalothorax; exopod of second antennae only one and one-half times as long as the endopod; fifth legs biramose, endopods 1-segmented, left exopod 3-segmented, right 2-segmented; the two legs about the same length. Total length, 3–3.75 mm.

Remarks.—The species may be recognized by the high crest, the 5 setae at the tip of the endopod of the second antennae, and the row of 10 to 13 short spines on the basipod of each fourth leg. In the male the structure of the last segment of the right fifth exopod is the most characteristic feature.

Genus UNDEUCHAETA Giesbrecht, 1888

Head fused with the first segment, with or without a crest; fourth and fifth segments fused with rounded posterior corners; urosome 4-segmented in female, 5-segmented in male; genital segment asymmetrical; exopod of second antennae less than twice the length of the endopod; exopod of first leg 2-segmented in female, 3-segmented in male, rami of the three following pairs of legs 3-segmented; fifth legs lacking in the female; present and biramose in the male.

KEY TO THE SPECIES (BOTH SEXES)

1. Head with a moderately high crest; genital segment in female with a ventral spine on the right side---------------------- **major** (p. 60)
   Head without a crest; genital segment in female with a dorsolateral spine on the right side------------------------------- **minor** (p. 61)

UNDEUCHAETA MAJOR Giesbrecht

FIGURE 39

Undeuchaeta major GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 227, pl. 37, 1892.

Occurrence.—One male and two females from trawl wings, Stations 2195, 2219, *Albatross;* five young males and adult females in vertical haul, Station 10313, *Grampus;* the former stations south of Nantucket.

Distribution.—Northern Pacific (Giesbrecht); northern Atlantic (With, Farran); southern Atlantic (Cleve); California coast (Esterly); Malay Archipelago (A. Scott); Gulf of Maine (Bigelow).

Color.—Body colorless and not very transparent, with red pigment scattered through the bases of the mouth parts, especially the maxillipeds. In the male the plumose setae of the caudal rami, the second antennae, and the mandibles are brightly colored. In alcohol and formalin the body takes on a uniform pinkish or reddish hue.

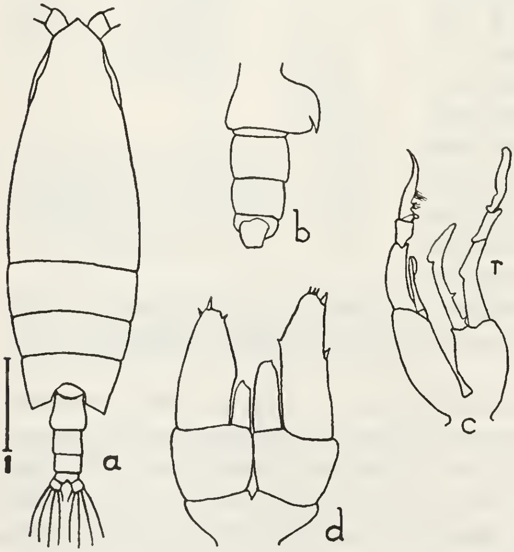

FIGURE 39.—*Undeuchaeta major: a,* Female, dorsal (after Sars); *b,* urosome, lateral; *c,* male, fifth legs (*b* and *c* after Giesbrecht); *d,* young male, fifth legs

Female.—Head with a prominent crest and a pointed rostrum; posterior corners of fused fourth and fifth segments angular but without spines; genital segment with a blunt process on the right side and a ventral protrusion, upon which is a stout spine at the right of the genital orifice, extending backward; exopod of second antenna one-half longer than endopod. Total length, 4.5–5.5 mm.

Male.—Head with prominent crest; posterior corners of fifth segment more angular, but without spines; exopod of second antennae only one-fourth longer than endopod; endopods of fifth legs 1-segmented, exopods 3-segmented; right endopod not reaching the center of the middle segment of the exopod; the latter only half as long as the end segment. In young males the rami of the fifth legs are all 1-segmented, exopods much larger than endopods. Total length, 4–4.9 mm.

Remarks.—This species may be recognized by the crest on the head, the asymmetry of the genital segment in the female, and the pattern of the fifth legs in the male. It occurs in great numbers off the coast of Ireland, but does not seem at all abundant on this side of the Atlantic. Bigelow has designated it as " one of the rarest of strays from the oceanic basin offshore."

UNDEUCHAETA MINOR Giesbrecht

FIGURE 40

Undeuchaeta minor GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 228, pls. 14, 37, 1892.

Occurrence.—Four females from trawl wings, Stations 2093, 2173, 2195, *Albatross*, south of Nantucket and Marthas Vineyard.

Distribution.—West coast of Ireland (Farran); Faroe-Shetland Channel (With); tropical and southern Atlantic (Cleve); Malay Archipelago (A. Scott); North Sea (Wolfenden, van Breemen); California coast (Esterly); tropical Pacific (Giesbrecht); Gibraltar, Indian Ocean (Thompson and Scott); Gulf of Maine (Bigelow).

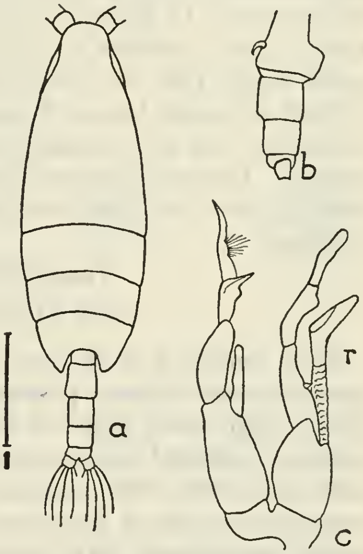

FIGURE 40.—*Undeuchaeta minor: a*, Female, dorsal (after Sars); *b*, female, urosome, lateral; *c*, male, fifth legs (*b* and *c* after Giesbrecht)

Color.—Body colorless but not fully transparent, with red pigment along the midline and on the bases of the mouth parts; the contents of the digestive tract are sometimes colored a deep orange-red. In the male the long setae of the caudal rami, the second antennae, and the swimming legs are sometimes tinted with bright colors.

Female.—Head without a crest; body considerably shorter and stouter than in the preceding species; genital segment armed on the right dorsolateral surface with a strong curved spine, on the left lateral surface at the posterior margin with two vertical rows of 4 to 10 teeth; exopod of second antenna about twice as long as endopod. Total length, 3.2–4.5 mm.

Male.—Head without a crest; urosome at least one-third as long as metasome; anal segment scarcely visible dorsally; endopods of fifth legs 1-segmented, exopods 3-segmented; right endopod reaching beyond the distal end of the middle segment of the exopod; the latter fully as long as the end segment. Total length, 3–3.9 mm.

Remarks.—This species may be identified by the absence of a crest and the presence of a curved spine on the dorsal surface of the genital segment in the female, and by the pattern of the fifth legs in the male. If A. Scott is correct in identifying the male of this species with Lubbock's *Undina plumosa*, then Lubbock's specific name would take the place of that given by Giesbrecht. This is difficult to decide, because Lubbock's description and figures are very imperfect, and so it seems best to retain the name *minor* for the present. Of this copepod Bigelow said: "So seldom entering the Gulf of Maine, its chief local interest is as flotsam from the Atlantic offshore."

Family EUCHAETIDAE

Genus EUCHAETA Philippi, 1843

Body slender with the head narrowed anteriorly and the rostrum more or less oblique; posterior corners of fifth segment covered below with dense tufts of hair; genital protuberance on ventral surface of genital segment very prominent in female; endopods of first and second legs 1-segmented, of third and fourth legs 3-segmented; exopods of first legs 2-segmented, of the three following pairs 3-segmented; fifth legs lacking in female; right fifth leg of male biramose, left uniramose.

KEY TO THE SPECIES (BOTH SEXES)

1. First antennae reaching beyond tips of caudal rami; genital segment symmetrical; 1 caudal seta on each side elongated. **spinosa** (p. 62)
   First antennae not reaching beyond first abdominal segment; genital segment asymmetrical; none of caudal setae elongated -- **marina** (p. 63)

EUCHAETA SPINOSA Giesbrecht

FIGURE 41

Euchaeta spinosa GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 410, pls. 16, 37, 1892.—SHARPE, Proc. U. S. Nat. Mus., vol. 38, p. 410, fig. 1, 1910.

Occurrence.—Reported by Sharpe from a surface collection off Nausett Beach, Cape Cod; also from Station 627, *Grampus*, off northern shore of Cape Cod.

Distribution.—Mediterranean (Giesbrecht); North Atlantic (Cleve); South Atlantic (Cleve, Stebbing); Indian Ocean (Thompson and Scott); Adriatic (Pesta); California coast (Esterly); off Cape Cod (Sharpe).

Color.—Body transparent with red spots in the head and thorax, and sometimes on the caudal rami; plumose setae of maxillipeds and caudal rami often with a wash of red, more or less intense; eye minute and ruby red.

Female.—Genital segment symmetrical, scarcely protruding ventrally, with a flaplike process on either side of the genital opening; second inner seta on each caudal ramus elongated; first antennae reaching about one segment beyond the caudal rami; end segment of second exopod invaginated at the base of the second spine on the outer margin; basipods and rami of fourth legs more or less covered with short spines. Total length, 6–6.2 mm.

Male.—Unknown.

Remarks.—This species can be distinguished most easily by the invaginated end segment of the second exopod. It must be quite rare, since it did not appear in the extensive collections made by the *Fish Hawk* and the *Albatross.*

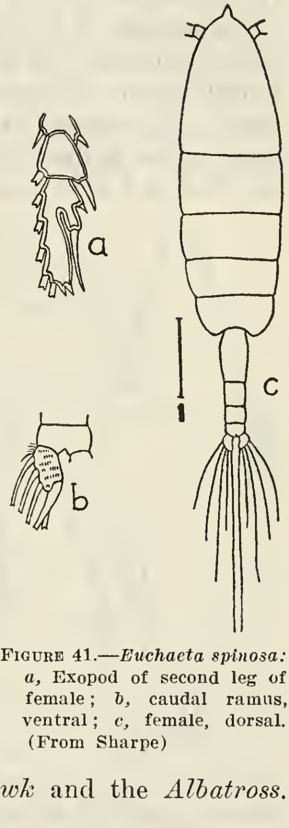

FIGURE 41.—*Euchaeta spinosa: a,* Exopod of second leg of female; *b,* caudal ramus, ventral; *c,* female, dorsal. (From Sharpe)

EUCHAETA MARINA (Prestandrea)

FIGURE 42

Cyclops marinus PRESTANDREA, Effemeridi Sci. e Lett. Sicilia, vol. 6, p. 12, 1833.
Euchaeta marina GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 245, pls. 1, 15, 16, 1892.

Occurrence.—Thirty males and females taken at the surface in Vineyard Sound; 2 females and 1 male, at the surface, Station 949, *Fish Hawk;* 10 males and females from trawl wings, Stations 2074, 2195, 2219, 2236, *Albatross.*

Distribution.—Messina (Philippi); tropical Atlantic (Dana); northern Atlantic (Cleve); Nizza (Claus); Australia, Mediterranean, South American coast (Giesbrecht); Canary Isles, Malta (Thompson); Red Sea, Indian Ocean (Thompson and Scott);

Adriatic (Pesta); Gulf of Guinea (T. Scott); Arabian Sea, Malay Archipelago (Cleve); Gulf of Maine (Bigelow).

Color.—General color a pale grayish blue, with blotches of dark red on the sides of the head opposite the mouth, on the bases of the mouth parts, and at the posterior corners of the thoracic segments. In the female there is a wide band of the same red across the posterior margin of the cephalothorax on the dorsal surface. This is not continuous with the lateral spots, but its end on each side is broken up into numerous branches very irregularly arranged. The eggs in the external ovisac are a deeper blue than the body, and are more or less spotted with white. Those in the internal oviducts are also blue and show quite distinctly through the body wall. The eye is minute and bright ruby red (Rathbun).

Female.—A pointed knob projecting forward just above the base of the rostrum; genital segment asymmetrical, the ventral process on the right of the genital opening much larger than the one on the left; caudal setae all about the same length, none of them elongated; appendicular setae thicker than the caudal setae and about twice as long as the body; first antennae reaching the second abdominal segment; basipods and rami of fourth legs smooth. Total length, 2.25–4 mm.

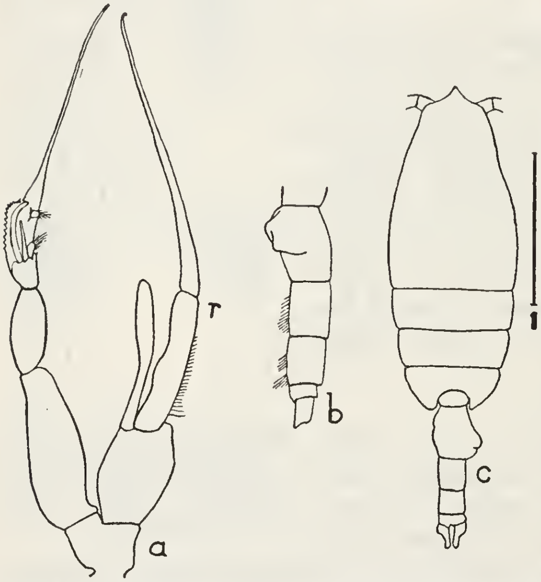

FIGURE 42.—*Euchaeta marina: a,* Male, fifth legs; *b,* female, urosome, lateral; *c,* female, dorsal

Male.—Body more slender than in the female; genital segment symmetrical; no appendicular setae; exopods of fifth legs ending in long stylet-shaped processes, the one on the right exopod 2-segmented, the left one 3-segmented; second segment of left exopod with a coarsely toothed process at the outer distal corner and a much shorter smooth one at the inner corner; end segment with two short processes tipped with tufts of hair; left endopod lacking, right endopod 1-segmented. Total length, 3–3.25 mm.

Remarks.—This species is characterized by the pointed process on the forehead, by the asymmetry of the genital segment in the female, and by the form of the fifth legs in the male. In the present area the copepod is probably a straggler, coming northward from the warmer tropical regions by way of the Gulf Stream.

Genus PARAEUCHAETA A. Scott, 1909

Head more or less fused with the first segment; posterior corners of fifth segment densely clothed with long hairs; spines at the apex of the maxillipeds densely fringed with short spinules only; the long spinules so characteristic of *Euchaeta* entirely absent; endopods of first and second legs 1-segmented, of third and fourth legs and all the exopods 3-segmented; fifth legs lacking in female, present and biramose in male; end segment of left exopod very short and rudimentary.

KEY TO THE SPECIES (BOTH SEXES)

1. Ventral protuberance on genital segment of female notched in center; end segment of left fifth exopod in male broadly rounded distally ---------- norvegica (p. 65)
   Ventral protuberance on genital segment of female notched at posterior corner; end segment of left fifth exopod in male pointed distally ---------- barbata (p. 67)

PARAEUCHAETA NORVEGICA (Boeck)

FIGURE 43

Euchaeta norvegica BOECK, Forh. Vid.-Selsk. Christiania, 1872, p. 40.—SARS, Crustacea of Norway, vol. 4, p. 38, pls. 24–26, 1902.

Paraeuchaeta norvegica A. SCOTT, *Siboga*-Expeditie, 29a, Copepoda, pt. 1, p. 69, 1909.

Occurrence.—Males and females in abundance from trawl wings, Stations 175, 935, 951, 953, 994, 1029, 1031, 1114, *Fish Hawk;* from trawl wings, Stations 2042, 2093, 2173, 2195, 2210, 2219, 2224, 2230, 2236, 2715, *Albatross;* from hauls with vertical net, Stations 10295, 20044, 20077, 20081, 20107, 20112, 20115, *Grampus;* from surface tow, Stations 34, 35, 36, *Fish Hawk;* from the stomach of a young hake taken in Vineyard Sound in 1878.

Distribution.—Norwegian coast (Boeck, Sars); Greenland, Iceland (Sars); North Sea (Möbius); North Atlantic (Cleve); Gulf of St. Lawrence (Willey); Davis Strait, Denmark Strait, Iceland, Faroe Channel, Greenland (With); Greenland (Vanhöffen); Gulf of Maine (Bigelow); Chesapeake Bay (Wilson).

Color.—In immature stages the body is light blue and translucent, the abdomen is perfectly transparent, the swimming legs are also transparent or slightly tinged with blue, the mouth parts are brick red or blood red, the color being deeper in some parts and fading away in others. This red pigment is sometimes diffused into the body near the mouth parts and posterior to them, especially on the ventral surface.

In the mature adult the body is light brown with a pinkish hue; at each joint is a narrow band of deeper color, generally one for each segment, making a double band at the joint. These bands are close together and are more pronounced on the sides of the body, but run well up toward the midline of the dorsal surface. They are sometimes connected by narrower curving bands, which give the surface the appearance of fine reticulation. The mouth parts are bright red, not always colored continuously, but sometimes in large blotches. The bases of the first antennae are colored like the body, but the rest of the appendages, including the swimming legs, are colorless. Above the mouth parts is a large patch of bright orange-red, of indefinite limits; at times it nearly covers the entire anterior end of the body, at others it may be limited to a very small spot. The eggs are large and very dark bluish brown, almost black. (Rathbun.)

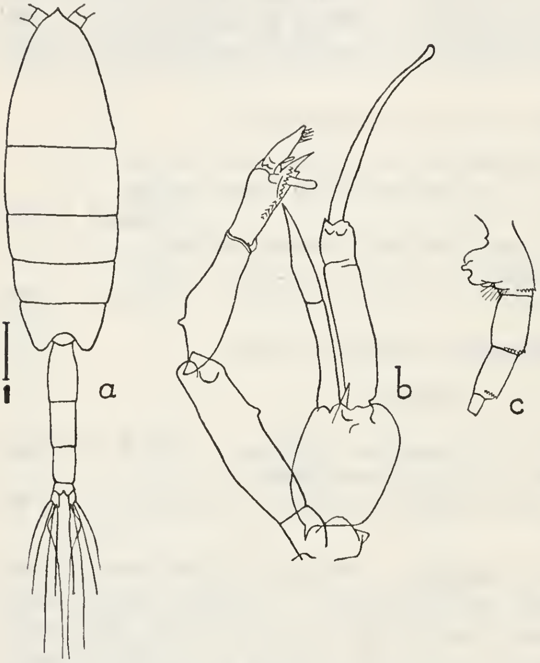

Figure 43.—*Paraeuchaeta norvegica:* *a*, Female, dorsal (after Sars); *b*, male, fifth legs, by Rathbun; *c*, urosome, lateral (after Giesbrecht)

Female.—Posterior corners of fifth segment somewhat produced and narrowly rounded; urosome more than half the length of the metasome; ventral protuberance on the genital segment very large and thick, and notched at the center; second inner seta on each caudal ramus much longer than the others; appendicular seta nearly as long as the body and strongly geniculate at its base. Total length, 7.5–8.5 mm.

Male.—Body very slender and elongate, the corners of the fifth segment not so prominent as in the female; urosome cylindrical, the anal segment almost obsolete; no geniculate setae; exopod of first legs distinctly 3-segmented; fifth legs considerably longer than the urosome; right exopod 2-segmented, endopod 1-segmented, longer than the basal segment of the exopod; left exopod 3-segmented, second segment shorter than the first, widened distally, with the inner margin coarsely dentate, thumb short and sharply pointed, dactylus or third segment also short, with a tuft of hairs on the inner margin near the tip. Total length, 6.5–7.5 mm.

Remarks.—This large and beautiful copepod appears to be quite a common calanid in the Woods Hole region. Bigelow obtained it in the Gulf of Maine in only two or three surface hauls, but in the contents of the vertical net at nearly 40 stations. This would seem to show that it prefers the deeper water when fully grown, and the size of the specimens obtained at the surface indicates that they are young and undeveloped.

PARAEUCHAETA BARBATA (Brady)

FIGURE 44

Euchaeta barbata BRADY, Voyage of H. M. S. Challenger, vol. 8, pt. 23, Copepoda, p. 66, pl. 22, figs. 6–12, 1883.—SARS, Crustacea of Norway, vol. 4, p. 41, pl. 28, 1901.

Paraeuchaeta barbata A. SCOTT, *Siboga*-Expeditie, 29a, Copepoda, pt. 1, p. 70, pl. 18, figs. 1–8, 1909.

Occurrence.—A single female from the trawl wings, Station 2236, *Albatross*, off Marthas Vineyard.

Distribution.—South Atlantic (Brady); Norwegian coast (Sars); North Atlantic (Farran, Pearson, With); tropical Pacific (A. Scott); North Sea (van Breemen).

Color.—Body a uniform bright red and quite opaque.

Female.—Head wholly fused with the first segment; posterior corners of fifth segment fringed with long hairs; ventral protuberance of genital segment smaller than in the preceding species, its apical lobules very unequal, the anterior one much the larger and curved backward like a beak; caudal rami hairy on both margins; appendicular bristles longer than the body and distinctly geniculate at the base. Total length, 10–12 mm.

Male.—Body shorter and more slender than that of the female; thumb of the chela at the tip of the left fifth leg coarsely toothed on its inner margin, two of the teeth near the tip larger than the others; finger curved and a little longer than the thumb; appendicular lobe cylindrical, with a curved claw at the distal end. Total length, 8–10 mm.

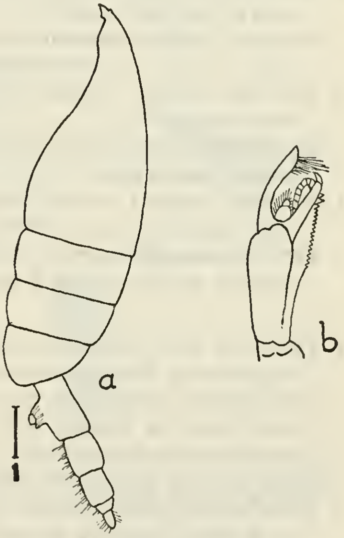

FIGURE 44.—*Paraeuchaeta barbata*: *a*, Female, lateral (after Sars); *b*, male, end segments of left fifth leg (after Sars)

Remarks.—This species has never before been reported from the American side of the Atlantic, but seems quite common in European waters. It may be distinguished by the unequal notching of the genital protuberance in the female and by the structure of the chela on the left fifth leg in the male.

Family PHAENNIDAE

Genus XANTHOCALANUS Giesbrecht, 1892

Metasome ellipsoidal, head separated from the first segment; fourth and fifth segments fused and produced at the posterior corners into acute lappets; exopods of first four pairs of legs 3-segmented; endopod of first legs 1-segmented, of second legs 2-segmented, of third and fourth legs 3-segmented; fifth legs uniramose, symmetrical in female, asymmetrical in male, the right leg rudimentary or even lacking.

KEY TO THE SPECIES

FEMALES

1. Each fifth leg with only 3 spines at tip, 1 terminal, and 1 on each lateral margin ---------- 2
   Each fifth leg with 4 spines at tip, arranged sometimes symmetrically, sometimes asymmetrically ---------- 3
2. All 3 spines equal in size; inner margins of 2 basal segments with a few small spines ---------- **greenii** (p. 68)
   Terminal spine considerably larger than other two; no spines on inner margins of basal segments ---------- **subagilis** (p. 70)
3. The largest of the 4 spines terminal, other 3 much smaller, all on outer margin ---------- **propinquus** (p. 73)
   Two of the spines terminal and unequal in size, the other two lateral, one on each side ---------- 4
4. Terminal segment one-half longer than wide; 2 basal segments with spines on their inner margins ---------- **borealis** (p. 70)
   Terminal segment twice as long as wide; inner margin of second segment smooth, of third segment with short hairs ---------- **pinguis** (p. 71)

MALES

1. Fifth legs about equal in length; right leg 4-segmented, left leg 5-segmented, end segment needle-shaped ---------- **subagilis** (p. 70)
   Left fifth leg much longer than right ---------- 2
2. Right fifth leg 6-segmented, almost reaching the center of fourth segment of left leg ---------- **pinguis** (p. 71)
   Right fifth leg 4-segmented and much shorter ---------- 3
3. Right fifth leg only reaching middle of first segment of left leg, its 3 distal segments as wide as long ---------- **propinquus** (p. 73)
   Right fifth leg reaching distal end of second segment of left leg, its 3 distal segments much longer than wide ---------- **borealis** (p. 70)

XANTHOCALANUS GREENII Farran

FIGURE 45

Xanthocalanus greenii FARRAN, Rep. British Assoc. Adv. Sci. for 1904, p. 603, 1905.—VAN BREEMEN, Nordisches Plankton, Zoologischer Teil, vol. 4, Entomostraca, Copepoden, p. 60, fig. 67, 1908.

Occurrence.—A single male and female from trawl wings, Station 2230, *Albatross*, south of Long Island.

Distribution.—Irish coast (Farran); south of Iceland (With); North Sea (van Breemen); Monaco Expedition (Sars); Bay of Biscay (With).

Color.—Not yet observed in the living copepod.

Female.—Head considerably narrowed anteriorly; posterior corners of fifth segment short and sharply pointed; urosome only one-fifth as long as metasome; first antennae a little longer than the body; the three segments of the fifth legs about the same length; the three spines of the terminal segment subequal in size, all three ciliated; inner margins of the two basal segments with scattered spines; posterior surface of terminal segment and distal end of second segment densely covered with stiff hairs. Total length, 5.5–6.5 mm.

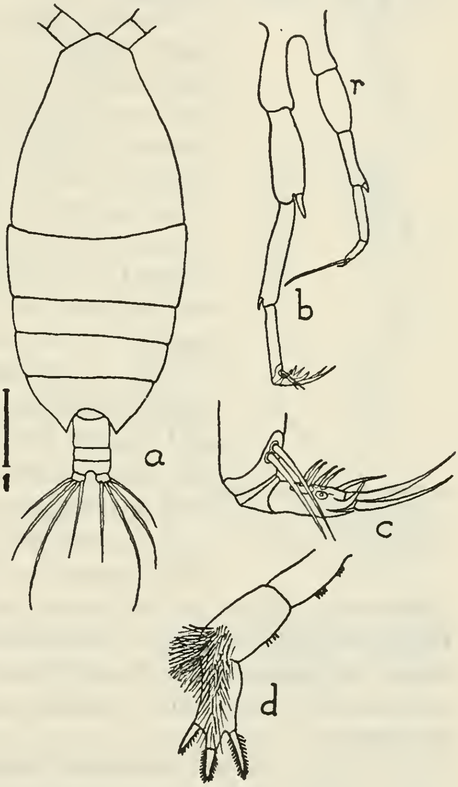

FIGURE 45.—*Xanthocalanus greenii: a,* Female, dorsal (after Farran); *b,* male, fifth legs; *c,* end segment of left fifth exopod; *d,* female, fifth leg

Male.—Posterior corners of fifth segment sharper than in the female; basal segments of first antennae considerably enlarged, with tumid outgrowths; urosome longer than in the female; fifth legs slender and elongate, each 5-segmented, the right leg reaching beyond the center of the third segment of the left leg; the latter shows a stout spine at the inner distal corner of the second segment, which may represent the rudiments of an endopod. Total length, 6.5 mm.

Remarks.—The two specimens here recorded were both badly damaged, so that any detailed description of the male is impossible. Fortunately the fifth legs were uninjured, and are represented in Figure 45, *b.* The tumid padlike outgrowths on the basal segments of the first antennae are unique, but seem to be natural rather than pathological; and, if so, furnish an excellent recognition character.

XANTHOCALANUS SUBAGILIS Wolfenden

FIGURE 46

Xanthocalanus subagilis WOLFENDEN, Journ. Marine Biol. Assoc., new ser., vol. 7, p. 118, pl. 9, figs. 17, 32, 1904.

Occurrence.—Five females from the trawl wings, Stations 2093, 2173, *Albatross*, south of Marthas Vineyard.

Distribution.—North Atlantic (Wolfenden).

Color.—Unrecorded for the living copepod; preserved specimens are a uniform light yellowish brown.

Female.—Head separated from the first segment; fourth and fifth segments fused, the posterior corners sharply angular; metasome three and one-half times as long as urosome; terminal segment of fifth legs with three setae unequal in size, the middle one larger than the other two; inner margin of second segment smooth, of basal segment with a rounded knob at the distal corner, fringed with short hairs; posterior surface of end segment with a few scattered hairs. Total length, 2.5–2.75 mm.

Male.—Left fifth leg 4-segmented, the terminal segment with two apical processes, one fingerlike and fringed with short hairs, the other subspherical and tipped with three unequal setae; right fifth leg 6-segmented, about as long as the left leg, its terminal segment long and needlelike. Total length, 2.3–2.5 mm.

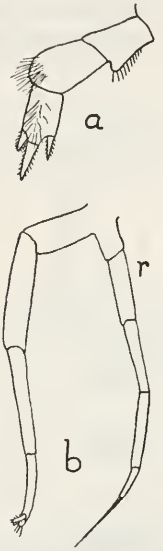

FIGURE 46.—*Xanthocalanus subagilis: a,* Female, fifth leg; *b,* male, fifth legs

Remarks.—With, in his report on the Copepoda of the Danish *Ingolf*-Expedition, made this species a doubtful synonym of Vanhöffen's *hirtipes*, but the form of the fifth legs in both sexes distinctly separates the two. This is the first record of the species from American shores.

XANTHOCALANUS BOREALIS G. O. Sars

FIGURE 47

Xanthocalanus borealis SARS, Norwegian North Polar Expedition, 1893–1896, vol. 1, no. 5, Crustacea, p. 49, pl. 11, 1900; Crustacea of Norway, vol. 4, p. 46, pls. 31, 32, 1901.

Occurrence.—Three females from trawl wings, Station 1029, *Fish Hawk*, off Marthas Vineyard.

Distribution.—North Atlantic (Farran); Polar Basin, Norwegian coast (Sars); North Sea (van Breemen); English seas (T. Scott).

Color.—Body in general translucent or transparent and whitish, with some light orange coloring extending through the center. This color is most dense anteriorly and gradually fades out in the abdomen. On the ventral surface of the body some distance behind the antennae and among the mouth parts is a spot of bright red. This is of considerable size, is nearly circular in outline, and stands out prominently. (Rathbun.)

Female.—Metasome twice as long as wide; fourth and fifth segments completely fused, the posterior corners forming acute lappets reaching behind the center of the genital segment; urosome a little more than one-fourth as long as metasome; fifth legs curved, inner margin of basal segment fringed with spines, of second segment with two or three spines only; end segment narrowed distally, with two unequal terminal spines and a single spine on each lateral margin, all four spines pectinate; distal end of second segment and the entire posterior surface of the terminal segment covered with stiff hairs. Total length, 3–4 mm.

Male.—Considerably smaller than the female; posterior corners of fifth segment rounded and shorter; urosome more than one-third as long as metasome; fifth legs very asymmetrical; right leg 5-segmented, but only reaching the end of the second segment of the left leg, the latter 6-segmented and very slender; terminal segment short, with a single terminal seta and a fringe of hairs on the inner margin. Total length, 2–3 mm.

Remarks.—In his Copepoda of the Danish *Ingolf*-Expedition, With made this species a synonym of Vanhöffen's *hirtipes*, but acknowledged that such a decision was difficult without specimens of both forms for comparison, which he did not have. He said size was not of much value in distinguishing species and discarded the characters found in the structure of the fifth legs. Under such treatment almost any two species of a given genus could be made synonymous. This species has not before been reported from American shores.

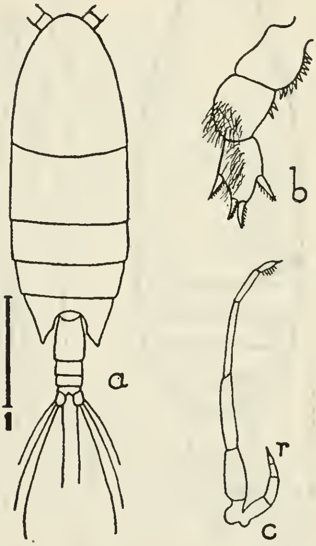

FIGURE 47.—*Xanthocalanus borealis: a,* Female, dorsal (after Sars); *b,* female, fifth leg; *c,* male, fifth legs (after Sars)

XANTHOCALANUS PINGUIS Farran

FIGURE 48

Xanthocalanus pinguis FARRAN, Rep. Fisheries Ireland, 1902–1903, pt. 2, p. 39, pls. 8, 9, 1905.—WITH, Danish *Ingolf*-Expedition, vol. 3, pt. 4, Copepoda 1, p. 236, fig. 77, pl. 7; figs. 2, *a–d*, 1915.

Occurrence.—Ten males and females from trawl wings, Stations 2093, 2173, 2230, *Albatross*, south of Long Island and Marthas Vineyard.

Distribution.—North Atlantic (Farran, Pearson); Iceland, Faroe Channel (With); North Sea (van Breemen).

Color.—Body a uniform light flesh color; abdomen and appendages colorless and transparent; no eye spot visible. (Rathbun.)

Female.—Metasome four times as long as urosome; fourth and fifth segments distinctly separated, the posterior corners of the fifth segment each produced into a small tooth; basal segment of fifth legs with a row of spines on the inner margin; second segment with stiff hairs at the outer distal corner; end segment with two terminal spines very unequal in size, and one spine on each lateral margin, all four spines setose; end segment more than twice as long as wide, much narrower distally, and hairy on its posterior surface. Total length, 4.5–5.25 mm.

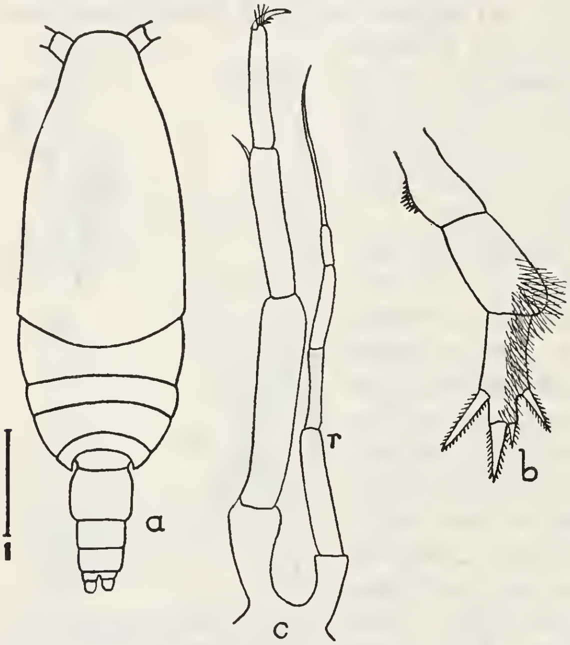

FIGURE 48.—*Xanthocalanus pinguis: a,* Male, dorsal; *b,* female, fifth leg; *c,* male, fifth leg

Male. — Metasome only three times as long as urosome; posterior corners of fifth segment rounded, without a tooth; fifth legs rather slender, right leg 6-segmented, reaching the center of the fourth segment of the left leg, the end segment longer than the two preceding it and needlelike; left leg 5-segmented, third segment with a seta at the outer distal corner, fourth segment with a rounded knob at the inner distal corner, tipped with three or four setae, terminal segment short and clawlike, with two small spines on its inner margin. Total length, 5 mm.

Remarks.—One of the specimens from Station 2230 was a young male, and it is well worthy of note that at this stage the legs of the male are hirsute like those of the adult female. Farran found this copepod at a depth of 630 fathoms, With's specimens came from a depth of 850 fathoms, while those here recorded were captured at even greater depths, which would indicate that this is a deep-water copepod living usually near the bottom. It has never before been reported from our American shores, though found in considerable abundance off Ireland.

XANTHOCALANUS PROPINQUUS G. O. Sars

Figure 49

Xanthocalanus propinquus Sars, Crustacea of Norway, vol. 4, p. 48, pl. 33, 1901.

Occurrence.—A single male from the trawl wings, Station 2230, *Albatross*, south of Long Island.

Distribution.—Arctic Ocean, Norwegian coast (Sars); Antarctic Ocean (Wolfenden).

Color.—Body transparent and colorless, without any noticeable pigment, but with a faint whitish tinge; eye bright ruby red. (Rathbun.)

Female.—Head distinctly separated from the first segment; fifth segment also separated from the fourth, its posterior corners produced into acute triangular processes reaching the center of the genital segment; urosome one-third as long as metasome; posterior surface of second, third, and fourth endopods with rows of small spines; fifth leg segments as wide as long, basal segment with a fringe of coarse spines on its inner margin, second segment fringed with short hairs, end segment with a large terminal spine, and three smaller ones in an oblique row on its outer margin, all four spines setose. Total length, 1.75 mm.

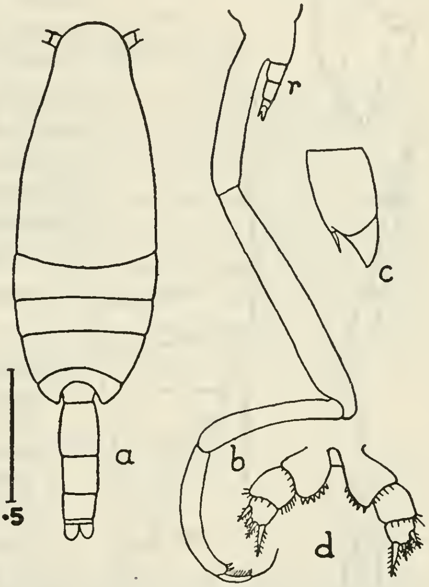

Figure 49.—*Xanthocalanus propinquus: a,* Male, dorsal; *b,* male, fifth legs; *c,* male, end segment of right fifth leg; *d,* female, fifth legs (after Sars)

Male.—Head and fifth segment separated as in the female; posterior corners of the latter smoothly rounded and very short; fifth legs extremely asymmetrical, the right one 3 (?4) segmented, not reaching the center of the first segment of the left leg and tipped with a small spine and a triangular process, the latter possibly the rudiment of a fourth segment; left leg 5-segmented, reaching far beyond the tips of the caudal rami. Total length, 2.4 mm.

Remarks.—This male obtained by Rathbun is probably a little larger than the one described by Sars, although the latter does not mention the size of his specimens. The separation of the head and of the fifth segment and the structure of the fifth legs, however, leave little doubt of the identity. This is the first report of the species from American shores.

Genus CORNUCALANUS Wolfenden, 1905

Head separated from the first segment; fifth segment also separated from the fourth, its posterior corners pointed or rounded; urosome 4-segmented in female, 5-segmented in male, anal segment minute; second maxillae with a stout, curved terminal claw; exopods of first four pairs of legs 3-segmented; first endopod 1-segmented, second endopod 2-segmented, third and fourth endopods 3-segmented; fifth legs uniramose in both sexes, symmetrical in the female, asymmetrical in the male. One species found here.

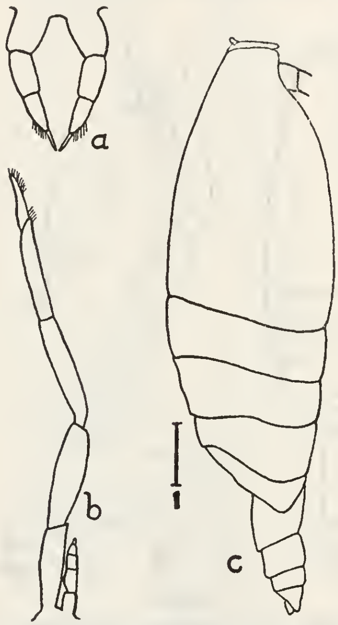

FIGURE 50.—*Cornucalanus chelifer:* *a,* Female, fifth legs; *b,* male, fifth legs; *c,* female, lateral

CORNUCALANUS CHELIFER (Thompson)

FIGURE 50

Scolecithrix chelifer I. C. THOMPSON, Ann. Mag. Nat. Hist., ser. 7, vol. 12, p. 21, pl. 5, figs. 1–9, 1903.

Cornucalanus chelifer WITH, Danish *Ingolf*-Expedition, vol. 3, pt. 4, Copepoda 1, p. 222, pl. 7, fig. 4, *a–h;* pl. 8, fig. 15, *a–g,* 1915.

Occurrence.—One female from the trawl wings, Station 2093, *Albatross;* 1 female taken in a vertical haul, Station 10313, *Grampus,* the former south of Marthas Vineyard.

Distribution.—Northern Atlantic (Farran); Indian Ocean (Wolfenden); Cape Verde Islands, Faroe Islands, Iceland (With).

Color.—Body a uniform yellowish white and more or less opaque, without pigment markings of any sort (Rathbun).

Female.—Forehead with a crest, at the upper end of which is a dorsal spine, pointed forward and downward; posterior corners of fifth segment triangular and bluntly rounded; urosome one-third as long as metasome; second maxillae with a stout terminal claw, acuminate and strongly curved; fifth legs 3-segmented, the two basal segments rather short and naked, the end segment slender, tapered, and tipped with a single spine and a fringe of hairs on the outer margin, just behind the terminal spine. Total length, 8–9 mm.

Male.—Head without a frontal crest and spine; posterior corners of fifth segment shorter than in the female and less angular; urosome only one-fourth as long as the metasome; fifth legs very asymmetrical, right leg 4-segmented, with a short terminal tooth, not reaching the end of the first segment of the left leg; the latter 5-segmented, the terminal segment hairy and tipped with a seta. Total length, 6.5–7 mm.

Remarks.—The large strong claw on the second maxillae is the best distinguishing character, together with the large size of the copepod. Rathbun's single sentence gives the first intimation of the color of this species, and it has never before been reported from our American shores.

Genus BRACHYCALANUS Farran, 1905

Head separated from the first segment, strongly arched dorsally, with a low crest in the male; fifth segment separated from the fourth, with rounded posterior corners, unarmed in the female, armed with small spines in the male; urosome 3-segmented in female, 5-segmented in male; first antennae much shorter than the metasome; exopods of first four pairs of legs 3-segmented; first endopod 1-segmented; second endopod 2-segmented; third and fourth endopods 3-segmented; fifth legs uniramose, 3-segmented in female, biramose, exopods 2-segmented, endopods 1-segmented in male. One species found here.

BRACHYCALANUS ATLANTICUS (Wolfenden)

FIGURE 51

Xanthocalanus atlanticus WOLFENDEN, Journ. Marine Biol. Assoc., new ser., vol. 7, p. 119, pl. 9, figs. 24, 25, 33, 1904.

Brachycalanus atlanticus VAN BREEMEN, Nordisches Plankton, Zoologischer Teil, vol. 4, Entomostraca, Copepoda, p. 66, fig. 77, 1908.

Occurrence.—A single male from the trawl wings, Station 2230, *Albatross*, south of Long Island.

Distribution.—North Atlantic, west of Ireland (Farran, Wolfenden); North Sea (van Breemen).

Color.—Nothing is known of the color of the living copepod.

Female.—Head strongly arched, without a crest; genital segment no wider than the abdomen, divided near the center; caudal rami as wide as long and well separated; basal segment of fifth leg wider than long, its inner margin densely fringed with spines; second segment also wider than long, with smooth margins; end segment twice as long as wide, with two terminal spines, stout and unequal, a large spine on the inner and a smaller one on the outer margin, all four denticulate; anterior surface of the entire leg covered with spines. Total length, 2–2.5 mm.

Male.—Head strongly arched, without a crest; genital segment no wider than the abdomen; urosome 4-segmented; anal segment very short, but as wide as the penultimate segment; caudal rami as wide as long, divergent; first antennae not reaching the posterior end of the fifth segment; second antennae and mouth parts similar to those of the female; endopods of swimming legs armed with transverse rows of stout spines. Basipods of fifth legs 2-segmented, the second segment somewhat swollen and armed at its outer distal corner with stiff setae; exopods 2-segmented, proximal segment with a single spine on the outer margin, distal segment tipped with two unequal spines, with a third shorter one on the inner margin; the entire anterior surface of the exopod is covered with stiff hairs. The endopods are very rudimentary, each consisting of a fingerlike process tipped with three or four minute setae. Total length, 2.25 mm.

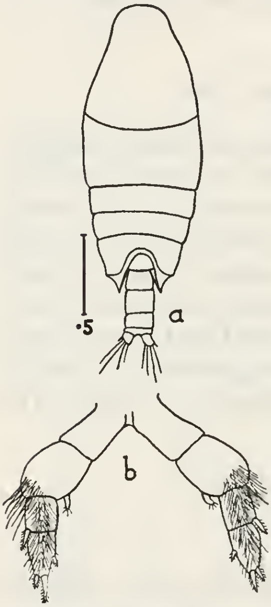

Figure 51.—*Brachycalanus atlanticus*: *a*, Female, dorsal; *b*, male, young, fifth legs

Remarks.—A. Scott described and figured an undeveloped male of *Brachycalanus gigas*, which is evidently closely related to the one here presented, yet specifically different. Evidently no fully matured males of this genus have thus far been found, and the present is the first record of any species of the genus upon American coasts. The separation of the head and the fifth segment, the very stout, slightly bifurcate, and strongly chitinized rostrum, and the structure of the fifth legs furnish distinguishing characters.

Family SCOLECITHRICIDAE

Genus SCAPHOCALANUS G. O. Sars, 1900

Head narrowed anteriorly, with or without a crest and completely fused with the first segment; fourth and fifth segments also fused, with angular corners in the female, rounded in the male; second inner caudal seta elongated; urosome 4-segmented in female, 5-segmented in male; exopods of first four pairs of legs 3-segmented; first endopod 1-segmented, second endopod 2-segmented, third and fourth endopods 3-segmented; the three posterior endopods with coarse spines on the posterior surface; fifth legs uniramose in female, biramose in the male, one or both basipods swollen.

KEY TO THE SPECIES

FEMALES

1. Inner marginal seta of fifth legs more than three times length of terminal segment; head with a crest---------------- magnus (p. 77)
   Inner marginal seta of fifth legs less than twice length of the terminal segment; head without a crest---------------------------------- 2
2. Apical and inner marginal setae of fifth legs close together, the former half as long as latter, or more--------------- obtusifrons (p. 79)
   Apical and inner marginal setae of fifth legs widely separated, former less than one-fourth as long as latter------------ validus (p. 78)

MALES

1. The 2 rami of left fifth leg about equal in length and each made up of 3 segments--- 2
   The 2 rami of the left fifth leg very unequal in length, the endoped 1-segmented, the exopod 3-segmented-------- obtusifrons (p. 79)
2. Right endopod 1-segmented, more than half as long as the narrow distal portion of second basipod------------------------ magnus (p. 77)
   Right endopod of fifth legs less than one-third as long as the narrow distal portion of second basipod----------------- validus (p. 78)

SCAPHOCALANUS MAGNUS (T. Scott)

FIGURE 52

Amallophora magna T. SCOTT, Trans. Linn. Soc. London, Zool., ser 2, vol. 6, pt. 1, p. 55, pl. 4, figs. 5–9, 1894.

Scaphocalanus magnus A. SCOTT, *Siboga*-Expeditie, 29a, Copepoda, pt. 1, p. 97, 1909.

Occurrence.—One female from trawl wings, Station 2219, *Albatross;* one male, surface tow, Georges Bank, 1872; three females, vertical haul, Station 20044, *Grampus.*

Distribution.—Antarctic Ocean (Wolfenden); North, South, and tropical Atlantic (Farran, Pearson, Wolfenden); North Pacific (Giesbrecht); California coast (Esterly); Malay Archipelago (A. Scott); Denmark Strait, Iceland (With); Norwegian coast (Sars); Faroe Channel, Gulf of Guinea (T. Scott); Arctic Ocean (Duc d'Orleans); Gulf of Maine (Bigelow); Greenland (Damas and Koefoed).

Color.—Body colorless and more or less opaque, without pigment markings.

Female.—Forehead with a long low crest; posterior corners of fifth segment sometimes angular, sometimes mucronate; first two segments of abdomen equal, each twice as long as the anal segment; fifth legs 3-segmented, the two free segments usually more or less completely fused and armed with three spines, one terminal, of moderate length and smooth, one on the inner margin, the longest of the three and setose distally, and one on the outer margin, smooth and very small. Total length, 3.7–5.25 mm.

Male.—No frontal crest; posterior corners of fifth segment smoothly rounded; anal segment much shorter than in the female; fifth legs scarcely reaching the middle of the first abdominal segment; basipods of left fifth leg long and cylindrical, the rami 3-segmented and about equal; second basipod of right leg enlarged proximally, endopod 1-segmented, awl-shaped, and attached to the enlarged base of the second basipod; exopod 3-segmented, attached to distal end of basipod. Total length, 4.5–4.75 mm.

Remarks.—This handsome calanoid, as pointed out by Sars, is a true arctic species and is found most abundantly in the far north, but it also occurs in the deeper waters of other oceans, even in the Tropics, and hence would naturally be expected in the Woods Hole area. The frontal crest of the female and the fifth legs of both sexes are the best characters for identification.

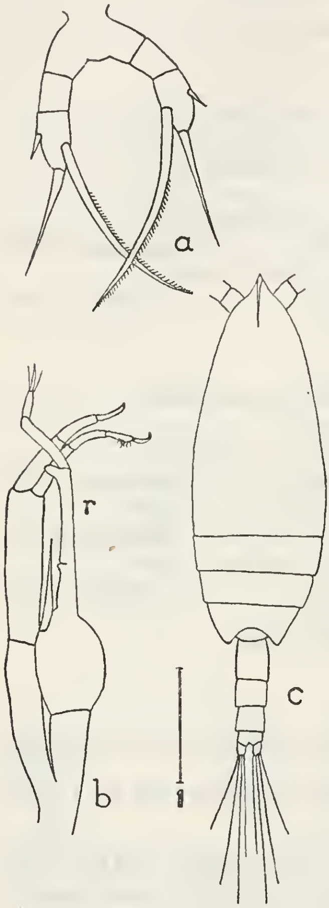

FIGURE 52.—*Scaphocalanus magnus: a,* Female, fifth legs; *b,* male, fifth legs; *c,* female, dorsal

SCAPHOCALANUS VALIDUS (Farran)

FIGURE 53

Scolecithrix valida FARRAN, Rep. Fisheries Ireland, 1906, pt. 2, p. 55, pl. 5, fig. 14, pl. 6, fig. 7, 1908.

Scaphocalanus validus WITH, Danish *Ingolf*-Expedition, vol. 3, pt. 4, Copepoda 1, p. 198, fig. 62, *a–f,* pl. 7, fig. 11, *a–b,* 1915.

Occurrence.—A male and a female from the trawl wings, Station 994, *Fish Hawk*, south of Marthas Vineyard.

Distribution.—North Atlantic, Irish coast (Farran); Malay Archipelago (A. Scott); between Scotland and Iceland (With).

Color.—Nothing is known of the color of the living copepod.

Female.—Head without a frontal crest; posterior corners of fifth segment rounded; rostrum with long undivided filaments; caudal rami one-half longer than wide; fifth legs apparently 2-segmented, the second and end segments fused, the spine on the inner margin as long as the fused segment and setose, the terminal spine one-third as long and setose, the outer spine smooth, minute, and in the female close to the base of the terminal spine. Total length, 3.2–3.75 mm.

Male.—Body smaller than that of the female, without a crest; posterior corners of fifth segment smoothly rounded; basipods of left fifth leg elongate and cylindrical, the rami 3-segmented, the exopod longer than the endopod; second basipod of right fifth leg spherically swollen proximally, strongly narrowed distally; endopod 1-segmented, less than one-third the length of the narrowed part of the second basipod; exopod 2-segmented, the end segment slender and curved into a hook at the tip without articulation.

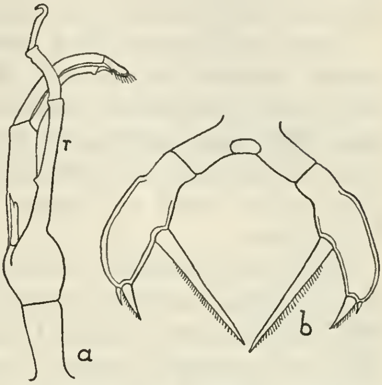

FIGURE 53.—*Scaphocalanus validus: a,* Male, fifth legs; *b,* female, fifth legs

Remarks.—These specimens were mixed with those of another genus from the same station and thus escaped Rathbun's attention, so that he made no notes on their color. They have never before been reported from the American side of the Atlantic.

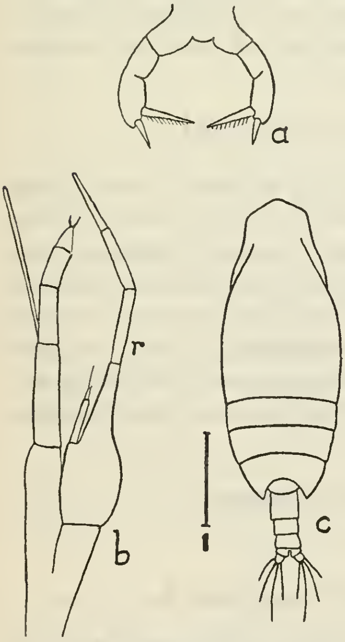

FIGURE 54.—*Scaphocalanus obtusifrons: a,* Female, fifth legs; *b,* male, fifth legs (after With); *c,* female, dorsal

SCAPHOCALANUS OBTUSIFRONS (G. O. Sars)

FIGURE 54

Amallophora obtusifrons SARS, Bull. Mus. Océanogr. Monaco, no. 26, p. 22, 1905.

Scaphocalanus obtusifrons WITH, Danish *Ingolf*-Expedition, vol. 3, pt. 4, Copepoda 1. p. 194, figs. 60, 61, pl. 7, fig. 9, *a–d*, pl. 8, fig. 8, *a–e*, 1915.

Occurrence.—A single female from the trawl wings, Station 2230, *Albatross*, south of Long Island.

Distribution.—North Atlantic (Sars, Farran); South Atlantic (Wolfenden); Denmark Strait, Iceland, Faroe Channel (With); Malay Archipelago (A. Scott); Gulf of Maine (Bigelow).

Color.—No observations of the color of the living copepod have been recorded; this specimen was a dull yellowish color, without pigment, but it had been in alcohol 42 years.

Female.—Metasome four times as long as urosome; rostral filaments bifurcate at the tip; first antennae extending beyond the caudal rami; exopod of second antenna one-fourth longer than endopod; fifth legs indistinctly 3-segmented, the end segment with a short apical spine, an inner spine twice the length of the apical one, close to the latter and setose, and no outer spine. Total length, 4.3–5.6 mm.

Male.—Body slender; urosome almost half as long as metasome; first antennae just reaching the caudal rami; fifth legs very slender, left basipods narrow, cylindrical, exopod 3-segmented, end segment short and strongly tapered, endopod 1-segmented, filiform, longer than the exopod; right endopod clavate, less than half as long as the narrowed portion of the second basipod, right exopod 3-segmented, the segments elongate and filiform. Total length, 3.75–4.25 mm.

Remarks.—This species can be recognized by the length of the first antennae and by the form of the fifth legs in both sexes. It was captured by Bigelow in deep water east of Georges Bank and just outside of the present area. Farran said: "This species is a noticeable feature of the deep water plankton off the west coast of Ireland at depths of 330 to 1,150 fathoms."

Genus SCOTTOCALANUS G. O. Sars, 1905

Head fused with first segment and bearing a frontal crest; fourth and fifth segments also fused, with angular corners; urosome 4-segmented in female, 5-segmented in male; rostrum bifurcate, each ramus with an articulated apical spine; apical lobe of second maxillae with a terminal claw, curved and setose; exopods of first four pairs of legs 3-segmented; first endopod 1-segmented, second endopod 2-segmented, third and fourth endopods 3-segmented; fifth legs uniramose in female, the end segment bearing only 2 spines, biramose in male. One species found here.

SCOTTOCALANUS PERSECANS (Giesbrecht)

Figure 55

Scolecithrix persecans Giesbrecht, Bull. Mus. Comp. Zool., vol. 25, no. 12, p. 253, pl. 3, figs. 6–12, 1895.

Scottocalanus persecans A. Scott, *Siboga*-Expeditie, 29a, Copepoda, pt. 1, p. 105, pl. 27, figs. 10–18, 1909.

Occurrence.—Three females taken in vertical hauls, Stations 20058, 20096, *Grampus*.

Distribution.—North Atlantic and Pacific (Giesbrecht); California coast (Esterly); South Atlantic (Cleve); Gulf of Maine (Bigelow).

Color.—Body colorless and somewhat opaque, turning white in formalin; eye a bright ruby red.

Female.—Head with a high frontal crest; genital segment convex ventrally; first antennae reaching the tips of the caudal rami; exopod of second antenna one-fourth longer than endopod; fifth legs relatively small, made up of two segments plus the fused basal portion, end segment with a minute apical spine and a stout outer spine, setose distally and more than three times the length of the segment itself, borne on a rounded process. Total length, 4.5–5.3 mm.

Male.—Head with high crest; first antennae just reaching the genital segment; basipods of left fifth leg stout, elongate, cylindrical, endopod 1-segmented, reaching the middle of the second exopod segment, exopod 3-segmented, the end segment much narrower than the other two, and tipped with two tiny setae; second basipod of right leg enlarged into a sphere at its proximal end, endopod 1-segmented, reaching beyond the tip of the second basipod, exopod 2-segmented and unarmed. Total length, 4.25–4.5 mm.

Remarks.—This species can be recognized by the high frontal crest and the form of the fifth legs in both sexes. The two *Grampus* stations recorded above are really outside the present area, but are fairly close to it, and with the distribution indicate that the species is likely to be found within the area at almost any time.

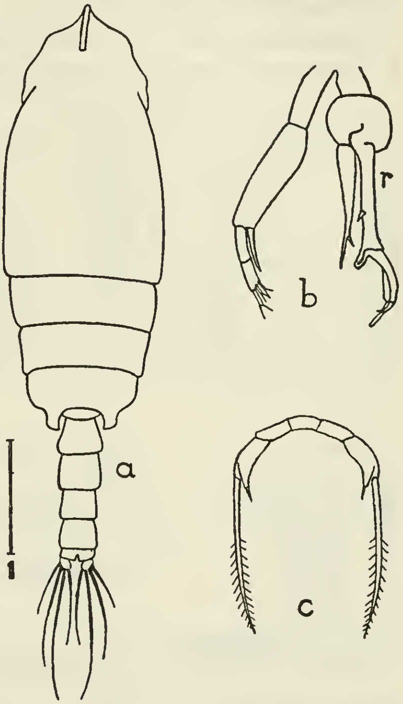

FIGURE 55.—*Scottocalanus persecans: a,* Male, dorsal (after A. Scott); *b,* male, fifth legs (after Giesbrecht); *c,* female, fifth legs

Genus SCOLECITHRIX Brady, 1883

Head fused with the first segment; fifth segment separated from the fourth, its posterior corners rounded; urosome 3- or 4-segmented in female, 5-segmented in male; first antennae no longer than the metasome; exopods of first four pairs of legs 3-segmented; first endopod 1-segmented, second endopod 2-segmented, third and fourth endopods 3-segmented; fifth legs lacking in the female, present and biramose in the male. One species found here.

SCOLECITHRIX DANAE (Lubbock)

FIGURE 56

Undina danae LUBBOCK, Trans. Ent. Soc. London, new ser., vol. 4, p. 21, pl. 4, 1856.

Scolecithrix danae GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 265, pls. 13, 37, 1892.

Occurrence.—Four females in surface tow on Georges Bank, 1874; 6 males and females in surface tow, Station 2210, *Albatross*, southwest of Gay Head; 7 females from trawl wings, Station 2195, *Albatross*, south of Nantucket.

Distribution.—North Atlantic (Lubbock, T. Scott, Cleve); New Holland and Japan (Brady); tropical Pacific (Giesbrecht); Canary Islands, Malta (Thompson); Indian Ocean (Thompson and Scott); Malay Archipelago (A. Scott); California coast (Esterly); Mediterranean (Giesbrecht); Gulf of Maine (Bigelow).

Color.—Body transparent and colorless except the following: Intestine, yellowish or reddish brown, with the same color appearing in scattered spots on the swimming legs and genital segment; flecks of red, irregularly arranged, appear on the dorsal surface of the thoracic segments; eye, bright ruby red. (Rathbun.)

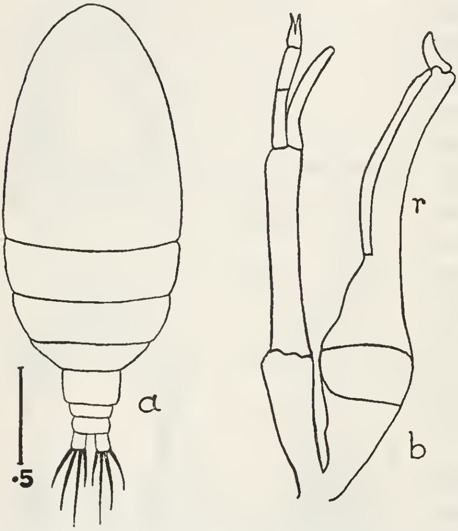

FIGURE 56.—*Scolecithrix danae: a,* Female, dorsal; *b,* male, fifth legs (after Giesbrecht).

Female.—Head without a crest; genital segment with a shovel-shaped protuberance on its ventral surface; abdominal segments wider than long; first antennae just reaching the genital segment; exopod of second antenna 5-segmented, twice as long as the endopod, the latter with eight setae. Total length, 2–2.25 mm.

Male.—A little smaller than the female; genital segment smooth ventrally; mouth parts not modified; right fifth leg uniramose, 5-segmented, the basipods distally and the exopod proximally swollen, end segment very short; basipods of left leg elongate cylindrical, reaching beyond the third segment of the right leg, exopod 3-segmented, end segment divided at the tip, endoped 1-segmented. Total length, 1.85–2.15 mm.

Remarks.—The distinguishing characters of this species are the shovel-shaped protuberance on the genital segment of the female and the form of the fifth legs in the male. This is a pelagic species and stays in the open ocean, but may be found either at the surface or near the bottom. In the female the eighth, ninth, tenth, and eleventh segments of the first antennae are usually fused into one long segment, which is quite conspicuous.

Genus SCOLECITHRICELLA G. O. Sars, 1902

Body comparatively short and stout; head fused with the first segment, with or without a crest; fourth and fifth segments fused with rounded posterior corners; urosome 4-segmented in female, 5-segmented in male; first antennae about as long as metasome; mouth parts somewhat modified in the male; exopods of first four pairs of legs 3-segmented; first endopod 1-segmented, second endopod 2-segmented, third and fourth endopods 3-segmented; fifth legs present in both sexes, uniramose and lamellar in the female, one or both legs biramose in the male.

KEY TO THE SPECIES (FEMALES)

1. Fifth legs symmetrical, 1-segmented, and lamellar___________ minor (p. 83)
   Fifth legs sometimes asymmetrical, 3-segmented____________ ovata (p. 84)

SCOLECITHRICELLA MINOR (Brady)

FIGURE 57

Scolecithrix minor BRADY, Voyage of H. M. S. *Challenger*, vol. 8, pt. 23, Copepoda, p. 58, pl. 16, figs. 15, 16, pl. 18, figs. 1–5, 1883.

Scolecithricella minor SARS, Crustacea of Norway, vol. 4, p. 55, pls. 37, 38, 1902.

Occurrence.—Two females were taken in a vertical haul, Station 10295, *Grampus*, east of Georges Bank.

Distribution.—Indian Ocean (Giesbrecht); Gulf of Guinea (T. Scott); North Atlantic (Brady, Farran); Davis Strait, Greenland, Iceland (With); South African coast (Cleve); Norwegian coast (Sars); Arctic Ocean (Damas and Koefoed); Gulf of Maine (Bigelow).

Color.—Body colorless and very transparent, the swimming legs with a faint wash of yellow and the eye ruby red.

Female.—Metasome three times as long as wide and three times the length of the urosome; genital segment constricted at its base and not protruding ventrally; first antennae just reaching the posterior corners of the fifth segment; second and third legs with scattered spines on the posterior surfaces of both rami; each fifth leg a broadly oval lamella, with two very unequal spines on the inner margin near the tip, and a tiny rudiment of a spine on the outer margin near the center. Total length, 1.25–1.5 mm.

Male.—Urosome almost half as long as metasome; anal segment very short; first antennae angularly curved near the middle, the proximal segments with numerous aesthetasks; fifth legs reaching beyond the caudal rami; left leg 4-segmented, the second segment (basipod) considerably enlarged, with a knoblike process at the inner distal corner, which probably is a rudimentary endopod; the end segment is flattened and spatulate; two basipods of the right leg are elongate and cylindrical, exopod 3-segmented, end segment bayonet-shaped, endopod 1-segmented, spiniform. Total length, 1. 2–1.4 mm.

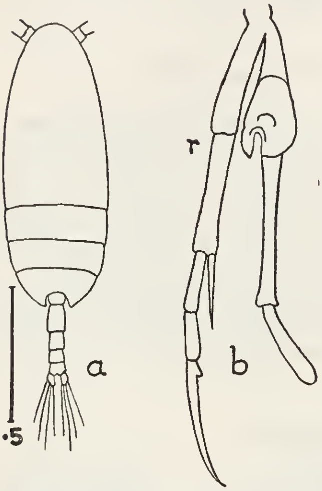

FIGURE 57.—*Scolecithricella minor: a,* Female, dorsal; *b,* male, fifth legs (after Sars)

Remarks.—Sars designated this copepod as a pelagic form, often found near the surface, and these statements were confirmed by With. It is probable, therefore, that it will be found nearer Woods Hole than the *Grampus* station cited above. Both sexes may be recognized by the form of. the fifth legs; Brady's Plate 16, Figure 16, labeled the fifth legs of the female, is obviously a mistake, as it is not like Plate 18, Figure 1, and does not represent the female fifth legs of this species.

SCOLECITHRICELLA OVATA (Farran)

FIGURE 58

Scolecithrix ovata FARRAN, Rep. Fisheries Ireland, 1902–1903, pt. 2, p. 37, pl. 6, figs. 13–18. pl. 8, figs. 1–5, 1905.

Scolecithricella ovata WITH, Danish *Ingolf*-Expedition, vol. 3, pt. 4, Copepoda 1, p. 208, pl. 7, fig. 14, *a–d*, pl. 8, fig. 12, *a–f*, 1915.

Occurrence.—Twenty females captured in vertical hauls, Stations 10295, 20044, *Grampus*, south of Georges Bank.

Distribution.—North Atlantic, off Ireland (Farran); Davis Strait, Iceland, Denmark Strait (With); Gulf of Maine (Bigelow).

Color.—The color of the living copepod has never been recorded.

Female.—Urosome less than one-fourth as long as metasome; genital segment not protruding ventrally; first antennae reaching the posterior margin of the genital segment; exopod of second antennae one-third longer than endopod; fifth legs more or less distinctly 3-segmented and somewhat asymmetrical, the segmentation better developed in the left leg, the spines on the right leg reduced to a single one on the inner margin of the end segment. Total length, 2.3–2.5 mm.

Male.—Young only known; fifth legs uniramose, 3-segmented.

Remarks.—This species is also pelagic and frequents the open ocean far from shore; it may be recognized by the structure of the fifth legs and the short urosome.

Family CENTROPAGIDAE

Genus CENTROPAGES Krøyer, 1849

Head narrowed anteriorly, with a distinct cervical depression on the dorsal surface; fifth segment separated from the fourth, its posterior corners rounded or pointed; urosome somewhat asymmetrical in the female, 3-segmented, symmetrical in the male, 4-segmented; first antennae reaching to or beyond the caudal rami, the right one transformed in the male; rami of the first four pairs of legs and of the fifth pair in the female 3-segmented; endopods of fifth legs in male 3-segmented, right exopod 3-segmented, the two end segments forming a strong chela, left exopod 2-segmented.

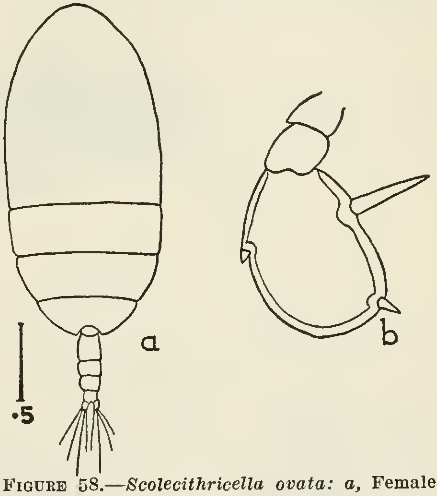

FIGURE 58.—*Scolecithricella ovata: a,* Female, dorsal; *b,* female, fifth leg

KEY TO THE SPECIES

FEMALES

1. Posterior corners of fifth segment rounded; urosome symmetrical ---------- bradyi (p. 86)
   Posterior corners of fifth segment with sharp spines; urosome more or less asymmetrical ---------- 2
2. First antennae reaching about 2 segments beyond tips of caudal rami; genital segment with several stiff spines ---------- typicus (p. 87)
   First antennae reaching base of caudal rami; genital segment with a single recurved spine on ventral surface ---------- hamatus (p. 89)

MALES

1. Posterior corners of fifth segment rounded; thumb of chela on right fifth leg laminate and bluntly rounded ---------- bradyi (p. 86)
   Posterior corners of fifth segment with sharp spines; both rami of chela on right fifth leg acuminate ---------- 2
2. First antennae with toothlike processes on some of the basal segments; fifth leg chela stout, overlapping caudal rami -- typicus (p. 87)
   First antennae without toothlike processes; fifth leg chela slender, scarcely reaching anal segment ---------- hamatus (p. 89)

CENTROPAGES BRADYI Wheeler

FIGURE 59

Centropages bradyi WHEELER, Bull. U. S. Fish Comm. 1899, vol. 19, p. 174, fig. 12, 1900.

Occurrence.—Four females from trawl wings, Station 2236, *Albatross*, off Marthas Vineyard; 30 males and females in surface tow on Georges Banks, September, 1874; 1 female in vertical haul, Station 20121, *Grampus*, northwest of Cape Cod.

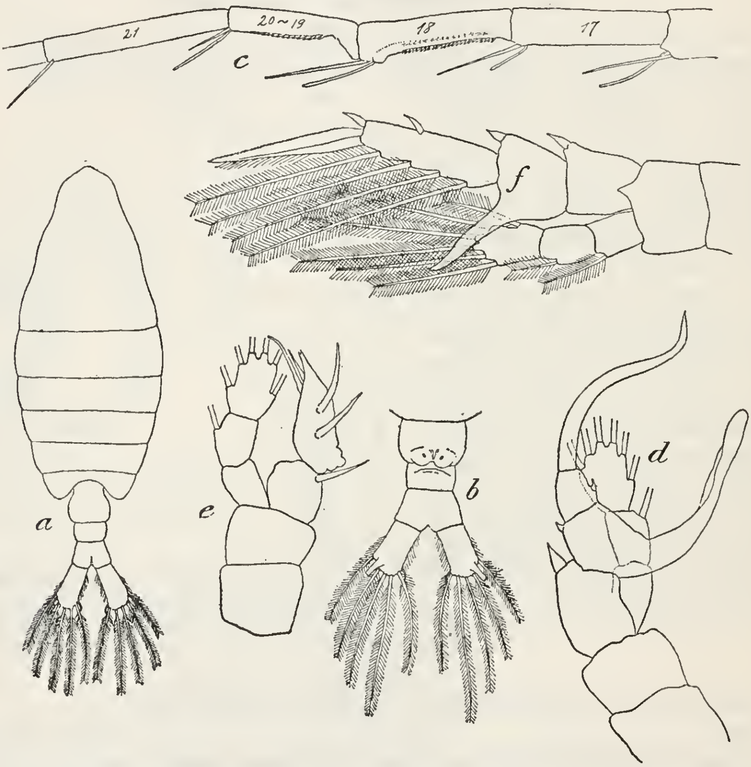

FIGURE 59.—*Centropages bradyi: a,* Female, dorsal; *b,* female, abdomen, ventral; *c,* male, right first antenna; *d,* male, right fifth leg; *e,* male, left fifth leg; *f,* female, fifth leg. (From W. M. Wheeler)

Distribution.—Gulf Stream south of Marthas Vineyard (Wheeler); Australia, Philippines, tropical Atlantic, southern Pacific (Brady); California coast (Esterly); Gulf Stream off Nova Scotia (Willey); Gulf of Maine (Bigelow).

Color.—Body rather opaque with a large purplish spot in the middle of the thorax; plumes of the second antennae and maxillae orange-yellow at their tips, elsewhere colorless (Wheeler).

Female.—First antennae extending three or four segments beyond the tips of the caudal rami; fifth segment with rounded corners; urosome symmetrical, without spines or knobs; each caudal ramus with a peglike process on the ventral surface at the distal margin between the two outer setae; endopod of fifth leg not reaching beyond the spine on the second segment of the exopod. Total length, 2–2.35 mm.

Male.—First antennae as long as in the female; fifth segment with rounded corners; caudal rami twice as long as wide, with a peglike process as in the female; thumb of the chela on the right fifth leg shorter than the finger, widened and flattened into a lamina, which is bluntly rounded at the tip; this chela is intermediate in size between those of the other two species here described. Total length, 2–2.25 mm.

Remarks.—This species is distinguished by the rounding of the posterior corners of the fifth segment, by the symmetry of the urosome, and by the pegs on the ventral surface of the caudal rami. It seems to be fairly well distributed throughout the area.

CENTROPAGES TYPICUS Krøyer

Figure 60

Centropages typicus Krøyer, Naturh. Tidsskrift, ser. 2, vol. 2, p. 588, pl. 6, 1849.—Sars, Crustacea of Norway, vol. 4, p. 75, pls. 49–51, 1902.

Occurrence.—Eight males and females in surface tow on Georges Bank, September, 1872; 100 males and females, surface tow, Menemsha Bight, Marthas Vineyard, September, 1882; 2 females, surface tow, Station 1222, *Fish Hawk;* 20 males and females, surface tow, Woods Hole Harbor, July, 1925.

Distribution.—Cape Finisterre (Krøyer); coast of France (Canu); British Isles (Brady); Helgoland (Claus); tropical and northern Atlantic (Cleve); coast of Norway (Sars); Skager Rak (Cleve); Gulf of Maine (Bigelow); Woods Hole (Fish, Wheeler); Chesapeake Bay (Wilson).

Color.—Body highly transparent, with reddish-brown pigment scattered irregularly throughout its entire length. In the male this pigment is more extensive than in the female, and extends into the bases of the mouth parts and the swimming legs. It often colors the whole of the mouth parts and the enlarged part of the right antenna. In the female the red or orange predominates in the anterior thorax and head, and extends posteriorly along the broad longitudinal muscles. This color also appears across the posterior margins of the last three thoracic segments, and on the dorsal surface of the genital and first abdominal segments. The oviducts have a bluish tinge; the eye is bright red, and behind the eye is a tiny black spot over the base of each first antenna (Rathbun). Wheeler's specimens were full of a dark bluish-black pigment, probably on account of the food they had eaten.

Female.—Metasome flattened; posterior corners of fifth segment expanded unequally, the right side the larger; genital segment asymmetrical, with four stiff spines, two subdorsal, two subventral, the former denticulate; first abdominal segment with a knob on the right side, none on the left; second inner caudal seta twice as long as the others. Total length, 1.25–1.75 mm.

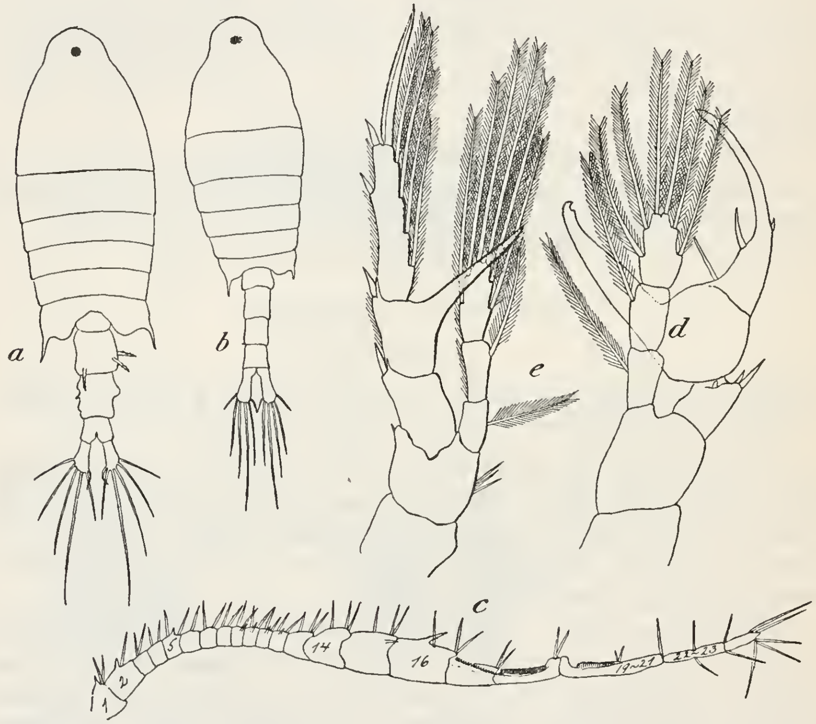

FIGURE 60.—*Centropages typicus: a,* Female, dorsal; *b,* male, dorsal; *c,* male, right first antenna; *d,* male, right fifth leg; *e,* female, fifth leg. (From W. M. Wheeler)

Male.—Body more slender than that of the female; corners of fifth segment less produced but more asymmetrical, the left one much the larger; urosome symmetrical, 4-segmented; chela of right fifth leg very powerful and overlapping the caudal rami; the thumb as long as the finger and both rami sharply pointed and curved inward toward each other at the tip. Total length, 1–1.6 mm.

Remarks.—Wheeler recorded this species as nearly always present in the tow taken from the wharf of the Bureau of Fisheries at Woods Hole, and Fish listed it as one of the two most typical summer pelagic species in Woods Hole Harbor. It is an in-shore form and apparently does not go out beyond the continental shelf, and is usually most abundant near the surface.

CENTROPAGES HAMATUS (Lilljeborg)

Figure 61

Ichthyophorba hamata Lilljeborg, De crustaceis ex ordinibus tribus: Cladocera, Ostracoda et Copepoda, in Scania occurrentibus, p. 185, pls. 21, 26, 1853.
Centropages hamatus Sars, Crustacea of Norway, vol. 4, p. 76, pl. 52, 1902.

Occurrence.—Eighteen males and females in a surface tow on Georges Bank, September, 1874; 2 females in surface tow in Woods Hole Harbor, September, 1881; 20 males and females in surface tow at Menemsha Bight, Marthas Vineyard, August, 1923.

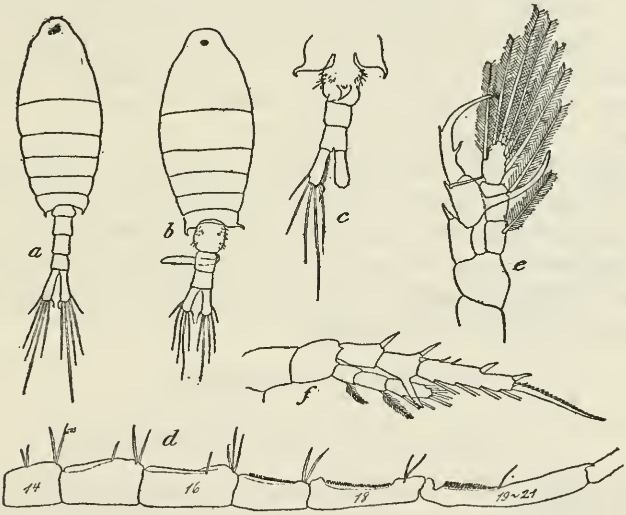

Figure 61.—*Centropages hamatus: a,* Male, dorsal; *b,* female, dorsal; *c,* female, abdomen, ventral; *d,* male, first antenna; *e,* male, right fifth leg; *f,* female, fifth leg. (From W. M. Wheeler)

Distribution.—North Atlantic (Cleve); British Isles (Brady, Thompson, Lubbock); Helgoland (Claus); Kattegat (Lilljeborg); Baltic Sea (Nordquist); Black Sea (Grebnitzky); North Sea (Möbius, Cleve); coast of Norway (Sars); Nova Scotia (Wright); Narragansett Bay (Williams); Gulf of Maine (Bigelow); Woods Hole (Wheeler, Fish); Chesapeake Bay (Wilson).

Color.—As it darts among the other transparent species it looks decidedly white and is thus easily distinguished from the rest. It is, however, banded in color; the tip of the head is transparent, then follows a whitish band extending nearly half the entire length of the body, then colorless or translucent for half the remaining length, and the posterior end is white again, or in one specimen brownish.

Bases of mouth parts dark, becoming transparent toward their tips; antennae, swimming legs, and caudal rami transparent; eye claret red (Rathbun).

Female.—Body smaller and more slender than in the preceding species; posterior corners of fifth segment less expanded, the spines shorter, the right one turned outward instead of backward; genital segment only slightly asymmetrical, finely ciliated along the sides, with a recurved spine on the ventral surface in front of the genital orifice; spine on inner margin of second exopod segment of fifth legs not half the length of the end segment; caudal rami about three times as long as wide. Total length, 1–1.35 mm.

Male.—Smaller than the female; posterior corners of fifth segment symmetrical; urosome half the length of the metasome; first antennae without dentiform processes on the anterior margin of any of the segments, the right antenna not swollen so much as in *typicus;* chela on fifth leg less powerfully developed, not reaching the caudal rami, the thumb a simple spine, shorter than the finger, and both very acuminate. Total length, 0.9–1.2 mm.

Remarks.—Wheeler found this species present in considerable numbers in the tow taken from the Bureau of Fisheries wharf at Woods Hole in July and August. Fish recorded it as one of the three copepods characteristic of winter plankton in Woods Hole Harbor, and said that the young become so abundant in January and February that they far outnumber the adults.

Family DIAPTOMIDAE

Genus DIAPTOMUS Westwood, 1836

Body slender, with a well-defined cervical depression across the center of the dorsal surface of the head; fourth and fifth segments imperfectly separated, the posterior corners biangular, with a minute spine at each angle; urosome 3-segmented; caudal rami much longer than wide; exopod of second antennae longer than endopod; rami of first 4 pairs of legs 3-segmented, except the first endopod, which is 2-segmented; exopod of fifth legs in female with a distinct terminal segment, carrying two spines; exopod of right fifth leg in male tipped with a long curved and denticulated claw; egg case single and ventral.

Remarks.—This genus has been but little investigated in New England. De Guerne and Richard in 1889 reported two species in the United States east of the Appalachians, *minutus* and *leptopus.* To these Marsh added in 1907 *oregonensis* from eastern Massachusetts, *birgei* from Cold Spring Harbor on Long Island, N. Y., and *spatulocrenatus* from Wigwam Pond, Nantucket, Mass. Forbes has reported the species *sanguineus* from Wellesley and Medford, Mass. All these species are here located definitely and quite abundantly in the Woods Hole area, one or more of them being found in almost every fresh-water pond examined.

KEY TO THE SPECIES

FEMALES

1. Endopods of fifth legs much shorter than basal segment of exopods, and without spines or setae ---- minutus (p. 92)
   Endopods of fifth legs about as long as basal segment of exopods ---- 2
   Endopods of fifth legs definitely longer than basal segment of exopods ---- 3
2. Seta on second basipod of fifth leg nearly as long as proximal exopod segment; second exopod segment dentate on inner margin; endopod setose at tip and armed there with 2 small spines ---- sanguineus (p. 93)
   Seta on second basipod less than one-fourth as long as proximal exopod segment; second exopod segment smooth on inner margin; endopod smooth at tip where it is armed with 2 plumose setae ---- leptopus (p. 94)
3. Inner margin of second segment of exopod of fifth leg smooth; third segment represented by 3 spines, the inner one longest ---- spatulocrenatus (p. 97)
   Inner margin of second segment of exopod of fifth leg fringed with setae or hairs; third segment represented by 2 spines only ---- 4
4. Spines on first basipod of fifth leg large, projecting beyond lateral margin; outer of the two spines representing third segment of exopod shorter than inner one ---- birgei (p. 98)
   Spine on first basipod of fifth leg minute, not reaching lateral margin; outer of the two spines representing third segment of exopod longer than inner one ---- oregonensis (p. 99)

MALES

1. Antepenultimate segment of right first antenna with a broad hyaline lamella extending beyond end of the segment; fifth endopods longer than first segment of exopod ---- leptopus (p. 94)
   Antepenultimate segment of right first antenna with a slender process, longer than penultimate segment; no hyaline membrane; right fifth endopod rudimentary and very short ---- minutus (p. 92)
   Antepenultimate segment of right first antenna with a curved process, shorter than penultimate segment; no hyaline membrane ---- 2
   Antepenultimate segment of right first antenna without either a membrane or a process ---- 3
2. Endopod of right fifth leg rudimentary and curved like a claw; basal exopod segment three-fourths as long as second segment; left endopod nearly as long as exopod, 2-segmented, spatulate, with crenate margin ---- spatulocrenatus (p. 97)

Endopod of right fifth leg short and straight; basal exopod segment scarcely one-third as long as second segment; left endopod 1-segmented, cylindrical and neither spatulate nor crenate-- sanguineus (p. 93)

3. Endopod of right fifth leg the same length as basal segment of exopod; latter with a quadrangular hyaline appendage; left exopod tipped with a chela--------------------------------- birgei (p. 98)

Endopod of right fifth leg definitely longer than basal exopod segment; no hyaline appendage; left exopod tipped with a single fingerlike process; no chela------------------- oregonensis (p. 99)

DIAPTOMUS MINUTUS Lilljeborg

FIGURE 62

Diaptomus minutus LILLJEBORG, Mém. Soc. Zool. France, vol. 2, p. 50, pls. 1, 3, 1889.—MARSH, Trans. Wisconsin Acad. Sci., vol. 15, p. 426, pls. 17, 18, 1907.

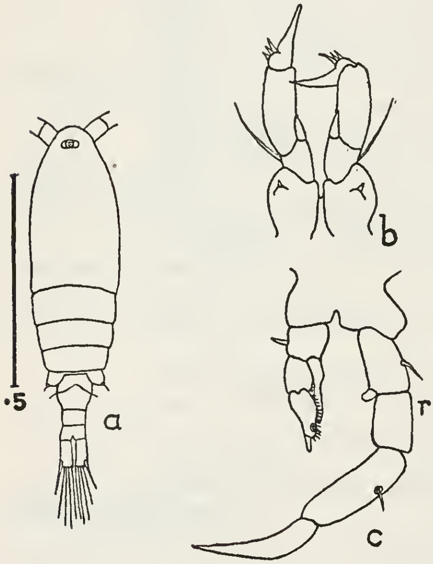

FIGURE 62.—*Diaptomus minutus: a,* Female, dorsal; *b,* female, fifth legs; *c,* male, fifth legs

Occurrence.—Fresh Pond, Nobska Point, Woods Hole, 500, both sexes; John Pond, Mashpee, 500, both sexes; Great Pond, Barnstable, 100, both sexes; Long Pond, Newton, 500, both sexes; Upper, Middle, and Lower Cotuit Ponds, Barnstable, 200, both sexes; Hinckleys Pond, Harwich, 50, both sexes; Mashpee Pond, Mashpee, 25, females; French Watering Place, Naushon Island, 25, females; Crescent Lake, Centerville, Barnstable, 75, both sexes; Seymour Pond, Brewster, 25, females; Long Pond, Brewster, 100, both sexes; Shallow Pond, Barnstable, 100, both sexes; Oyster Pond, Falmouth, 25, females; West End Pond, Naushon Island, 15, females; Browns Pond, Falmouth, 15 females; Jenkins Pond, Falmouth, 20, females; Mares Pond, Falmouth, 50, both sexes; Lovells Pond, Barnstable, 75, both sexes.

Distribution.—Greenland (Lilljeborg); Iceland (De Guerne and Richard); Newfoundland (Schacht); Great Lakes, Michigan, Wisconsin (Marsh).

Color.—Body fairly transparent, mouth and surrounding regions, and sometimes the entire cephalothorax bright orange-red; ends of first antennae, particularly in the male, reddish; thoracic segments outlined dorsally in blue; ovaries and oviducts dark blue; eggs pale bluish green, with a reddish center and nearly opaque; eye dark blue.

Female.—One of the smallest species; head fused with first segment; fifth segment more or less separated from the fourth, with rounded posterior corners, each armed with a minute spine; genital segment longer than the abdomen, with a small spine at the center of each lateral margin; caudal rami twice as long as wide; spines on first basipods of fifth legs minute; endopods rudimentary and unarmed; hook on second exopod segment nearly straight; third exopod segment represented by 2 or 3 spines, the inner one the longer. Total length, 0.9–1.15 mm.

Male.—Antepenultimate segment of right first antenna with a slender finger process at its outer distal corner, which often reaches the tip of the end segment; second basipod of right first leg subquadrate, longer than wide, the lateral spine at the center; second exopod segment twice as long as the first, its lateral spine nearer the base; right endopod a mere knob; left endopod reaching beyond the center of the end segment of the exopod and unarmed; exopod terminating in a fingerlike process, the end segment with a sinuous inner margin fringed with hairs. Total length, 0.9–1 mm.

Remarks.—The females carry from two to six eggs; when even, the eggs are arranged in pairs; when odd, the single egg is posterior to the others and between them. In the Upper Cotuit Pond none of the specimens showed any red but were all pale brown or colorless, and the majority of them were covered with algal growths. In the Lower Cotuit Pond 80 per cent were bright red, and not a single one showed algal growths. This is a northern form, which comes a little farther south near the Atlantic coast than it does in the Mississippi Valley. It may be recognized most easily by its small size and by the structure of the fifth legs in both sexes.

DIAPTOMUS SANGUINEUS Forbes

FIGURE 63

Diaptomus sanguineus FORBES, Bull. Illinois Mus. Nat. Hist., vol. 1, pp. 15, 16, 23, figs. 24, 28–30, 1876.—MARSH, Trans. Wisconsin Acad. Sci., vol. 15, p. 478, pl. 25, figs. 2, 5, 8, 1907.

Occurrence.—Twenty specimens, including both sexes, were obtained from a small ice pond on Cuttyhunk Island, July, 1926.

Distribution.—Found quite generally in the Mississippi Valley as far east as New York, as far north as Wisconsin and Minnesota, as far west as Nebraska, and as far south as Alabama (Marsh); Wellesley and Medford, Mass. (Forbes).

Color.—Transparent with a decided azure-blue tint, deepest at the bases of the swimming legs and along the grooves between the segments; ovaries and oviducts blood red, showing very prominently through the body walls; first antennae yellow; eye deep carmine-red.

Female.—Head fused with the first segment; fifth segment produced laterally at the posterior corners and armed on either side with two spines; genital segment widened anteriorly, with a prominent spine near the center of each lateral margin; caudal rami fringed with cilia on their inner margins; spines on first basipods of fifth legs minute; setae on second basipods as long as the basal segments of the exopods; hook on second exopod segment with a dentate inner margin; third segment represented by two spines, the inner longer than the outer; endopods about the same length as the basal segments of the exopods, each tipped with two short spines. Total length, 1.4–2.15 mm.

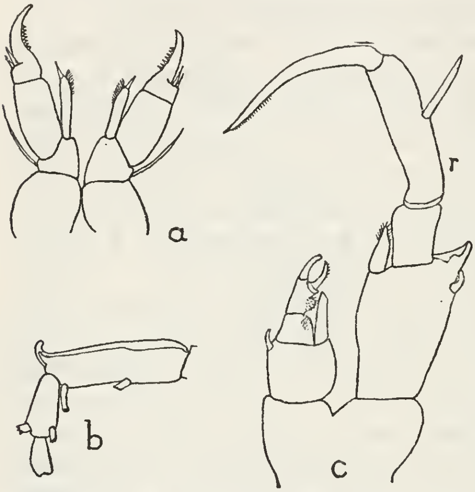

Figure 63.—*Diaptomus sanguineus: a,* Female, fifth legs; *b,* male, tip of right first antenna; *c,* male, fifth legs

Male.—Right first antenna swollen, antepenultimate segment with a stout recurved hook at its outer distal corner; second basipod of right fifth leg trapezoidal, its outer corner produced into a blunt spine; second exopod segment three times as long as the first, the terminal claw denticulate distally; endopod reaching the center of the basal exopod segment; left fifth leg only reaching the tip of the right basipod, its rami subequal, the exopod tipped with two curved processes, forming a sort of chela. Total length, 1–2 mm.

Remarks.—The little ice pond in which these specimens were found is only 40 feet in diameter and is nothing but a stagnant pool, very shallow during the summer and entirely filled with vegetation. The species may be recognized by the color of the ovaries and oviducts, by the hook on the first antenna of the male, and by the structure of the fifth legs in both sexes.

DIAPTOMUS LEPTOPUS Forbes

Figure 64; Plate 1, *f*

Diaptomus leptopus Forbes, Amer. Nat., vol. 16, p. 646, pl. 8, figs. 17–19, 1882.—Marsh, Trans. Wisconsin Acad. Sci., vol. 15, p. 443, pl. 20, 1907.

Occurrence.—Both sexes found in abundance in a small pond of fresh water west of Edgartown on Marthas Vineyard.

Distribution.—Mississippi Valley (Marsh); Minnesota (Herrick); Colorado, Illinois (Forbes); Kentucky (Chambers); Woods Hole (Forbes, M. and R. Rathbun).

Color.—Body a light transparent blue, the first antennae having the same color at the base. The blue color of the body reaches the last metasome segment, and there changes to a light bright orange-yellow, sometimes a lemon-yellow, irregularly edged behind and below with a deep orange-red. The yellow often occurs also on the ventral and lateral margins of the preceding segments. The urosome segments present a combination of orange-yellow and the brightest deepest red imaginable, being lightest near the metasome and deepest toward the anal segment. The colors vary greatly as to intensity; sometimes the first 2 or 3 segments contain but little red, but the last segments are always of a deep color. On the anterior urosome segments the red usually is most intense near the posterior margin, often leaving but little yellow.

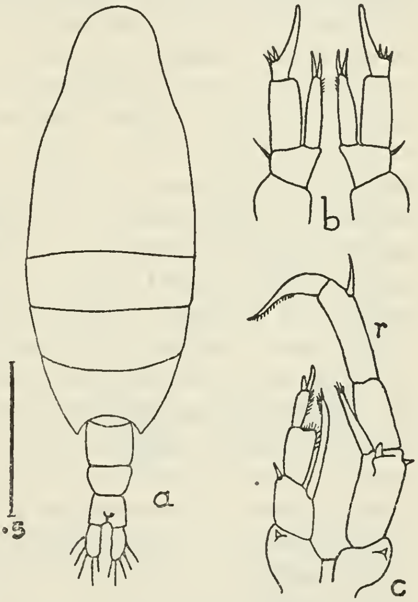

FIGURE 64.—*Diaptomus leptopus: a,* Male, dorsal; *b,* female, fifth legs; *c,* male, fifth legs

In the first antennae 4 or 5 of the basal segments are blue; then begins orange-yellow, with some red on the upper and outer margins of the segments. The color then grows deeper, the red gradually overshadowing the yellow, the segments being most deeply colored outwardly. At a point about two-thirds of the length of the antenna the yellow disappears, and the red becomes as deep and intense as at the tip of the urosome. The posterior legs are yellowish, the remaining appendages light blue and transparent, with the last one or two segments yellowish, sprinkled with small spots of red, which are larger and brighter on the mouth parts than on the legs.

Eye spot large, irregular in shape and crystal red; front part of the head around it colorless. A little yellow is usually scattered through the blue of the body, but is nowhere at all prominent. It is impossible adequately to describe the appearance of this copepod, which far exceeds in beauty any of the marine forms thus far obtained (Rathbun).

Female.—Head fused with first segment; fourth and fifth segments also fused, with rounded posterior corners; genital segment not quite so long as the abdomen and usually divided near the center as in the figure; inner margins of the caudal rami ciliated. First antennae reaching tip of caudal rami; first basipod segment of fifth legs considerably swollen, with a small ventral spine; second basipod with a minute lateral seta; second exopod segment with smooth margins; third segment represented by two stout spines, the outer one the smaller; a third spine on the outer margin of the second segment. Total length, 1.5–1.9 mm.

Male.—Smaller than female but similar in color and general details. Right antenna much swollen anterior to the geniculating segment; a narrow hyaline membrane on the antepenultimate segment, prolonged slightly at the distal end into a small knob. First basipod of fifth leg with a small ventral spine; second basipod of right leg quadrangular, twice as long as wide, with a shelf-like projection on the posterior surface near the distal end, from which arises a blunt curved hook. Second exopod segment 4 times as long as wide, with a small process at its base inside and a lateral seta outside near its tip. The apical spine is slender, nearly straight, and denticulate on its inner margin. The right endopod is slender and a little longer than the basal segment of the exopod, tipped with minute setae and fine hairs. The left exopod is 2-segmented, the second segment much narrower than the first, with an apical plumose seta and a dactylose process; left endopod longer than basal segment of exopod, and tipped with fine hairs. Total length, 1.25–1.5 mm.

Development stages.—In a young female 1 mm. long the basipod segments of the fifth legs are comparatively larger, while the rami are 1-segmented and reduced in size. The exopods are a half longer than the endopods and each of the 4 rami is armed with two apical setae of about the same length. The endopod has an invagination near the center of the outer margin, indicating its approaching division, but there is no sign of the long spine, which appears on the second segment in the adult. The two setae at the tip of the exopod represent the third segment in the mature adult, and the minute spine which appears behind them in the adult belongs to the second segment.

In a young male 1.25 mm. long the left fifth leg is nearly as long as the right; the endopods are cylindrical, reaching to the middle of the second exopod segment and tipped with several minute setae and hairs. The exopods are 2-segmented, the distal segment longer than the proximal, considerably tapered, with a rather stout apical spine and a much smaller one on the outer margin. This male had already reached the minimum size for adults and would probably have had but one more molt before assuming the adult form. Hence the fifth legs undergo considerable metamorphosis even in the last molt.

Remarks.—This is the most highly colored copepod in the present area and may be recognized by that fact alone; the details of the fifth legs in both sexes also furnish additional characters. Both Forbes and Rathbun gave "a fresh-water pond, Woods Hole," as a habitat of this species, but the present author has not been able to find it in Woods Hole.

DIAPTOMUS SPATULOCRENATUS Pearse

FIGURE 65

Diaptomus spatulocrenatus PEARSE, Amer. Nat., vol. 40, p. 246, figs. 6–9, 1906.—MARSH, Trans. Wisconsin Acad. Sci., vol. 15, p. 456, 1907.

Occurrence.—Both sexes were found in great abundance in a small lily pond south of Ashumet Pond, Falmouth; a small pond near the outlet of John Pond, Mashpee; Oyster Pond, Falmouth; John Pond, Mashpee; Flax Pond, Bourne; Red Brook Pond, Bourne; Mares Pond, Falmouth.

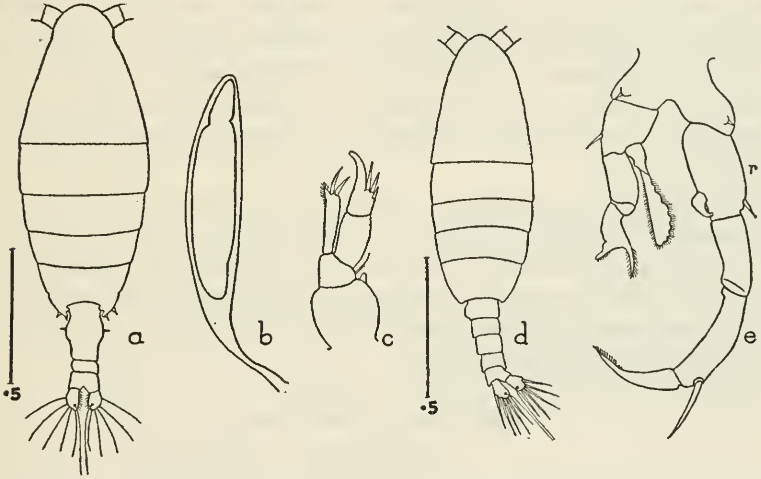

FIGURE 65.—*Diaptomus spatulocrenatus: a,* Female, dorsal; *b,* spermatophore; *c,* female, fifth leg; *d,* male, dorsal, showing twist to the right; *e,* male, fifth legs

Distribution.—Reported hitherto only from Wigwam Pond on Nantucket Island, from which Pearse obtained his type specimens, and Lake Sebago, Me. (Marsh).

Color.—Transparent with a bluish tinge, and with reddish-brown irregular spots around the bases of the swimming legs; sometimes these spots cover nearly the entire ventral surface; distal half of first antennae in the female, and the enlarged portion of the grasping antenna in the male bright orange-red; ovaries, oviducts, and eggs reddish brown; eye dark red.

Female.—Head more or less separated from the first segment; fifth segment produced at its posterior corners and armed with two short spines on each side; genital segment longer than the abdomen; caudal rami fringed with cilia on their inner margins; spines on basipods of fifth legs large, protruding beyond the lateral margins; setae on second basipod minute and hairlike; endopod much longer than basal segment of exopod, tipped with two subequal spines and a sharp inner process, fringed with cilia; hook on second exopod segment smooth; third exopod segment represented by two spines, the inner the longer. Total length, 1.4–1.6 mm.

Male.—Urosome sometimes symmetrical, sometimes twisted to the right; grasping antenna considerably swollen; posterior corners of fifth segment angular but without spines; second basipod of right fifth leg twice as long as wide, with convex lateral margins; endopod a rudimentary curved process on inner margin of second basipod, near the distal end; second exopod segment one-half longer than first, the lateral spine near the tip; end claw stout and setose on the inner margin distally; rami of left fifth leg equal, endopod 2-segmented, spatulate, its inner margin crenate, exopod tipped with a curved spine and a finger process, both setose. Total length, 1.25–1.35 mm.

Remarks.—The fifth legs are peculiar in both sexes and will serve to identify the species. In 75 per cent of the specimens from the two ponds in Bourne the urosome of the female was twisted to the left and that of the male to the right. The species will probably be found elsewhere on the cape and on Marthas Vineyard, as the ponds are more thoroughly examined.

DIAPTOMUS BIRGEI Marsh

FIGURE 66

Diaptomus birgei MARSH, Trans. Wisconsin Acad. Sci., vol. 9, p. 16, pl. 1, figs. 4–6, 1894; vol. 15, p. 435, pl. 18, figs. 6, 8, pl. 19, figs. 1, 6, 1907.

Occurrence.—Both sexes found in abundance in a small lily pond just south of Falmouth Arms Hotel, on the east shore of Buzzards Bay; a small lily pond north of Nobska Lighthouse; Crockers Pond, Falmouth; Ice Pond, Quisset, Falmouth; Flax Pond, Falmouth.

Distribution.—Wisconsin (Marsh); Indiana (Juday, Marsh); Cold Spring Harbor, Long Island (Pratt); Washington, D. C. (Marsh); North Carolina (Coker); Ontario, New Brunswick (Klugh).

Color.—Body transparent, washed with light blue, which is deepened into a dark-blue stripe along the posterior margins of the metasome segments; distal half of first antennae and the first four pairs of legs orange; fifth legs and bases of the other four pairs dark blue; oviducts and eggs reddish brown; eye blue.

Female.—Head fused with first segment; fifth segment rounded at posterior corners and armed with a single spine on either side; genital segment considerably dilated ventrally, with a pointed process on each lateral margin nearer the base; first abdominal segment only one-seventh as long as anal segment; caudal rami fringed with hairs on both margins; spines on first basipods of fifth legs projecting beyond the lateral margins; setae on second basipods fairly long and stout; endopod longer than basal segment of exopod, setose on inner margin distally, with 2 equal apical spines; hook of second exopod segment setose on inner margin; spines representing third segment subequal, the inner one a little the longer. Total length, 1.2–1.4 mm.

Male.—Grasping antenna much swollen; antepenultimate segment with a blunt process at its outer distal corner; basal segment of right fifth exopod wider than long, with a broad, rectangular hyaline process on its inner margin; distal segment enlarged at its base, the outer spine long and stout and nearer the base and serrulate on its inner margin, the terminal claw as long as the entire leg, strongly curved and denticulate on the inner margin; endopods of both legs conical, 1-segmented, and longer than the basal segments of the exopods; left exopod tipped with a fingerlike process and a falciform spine. Total length, 1.1–1.25 mm.

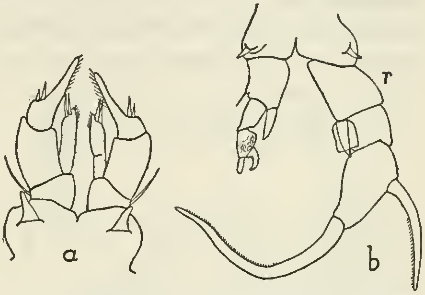

FIGURE 66.—*Diaptomus birgei: a,* Female, fifth legs; *b,* male, fifth legs

Remarks.—The fifth legs furnish the best identification for the species. It is evidently well distributed in the small ponds along the eastern shore of Buzzards Bay in the towns of Falmouth and Bourne. When placed in a preservative both sexes wind their antennae around the body spirally and distort the urosome in various directions, making them very difficult to examine.

DIAPTOMUS OREGONENSIS Lilljeborg

FIGURE 67

Diaptomus oregonensis LILLJEBORG, Mém. Soc. Zool. France, vol. 2, p. 53, pls. 2, 3, 1889.—MARSH, Trans. Wisconsin Acad. Sci., vol. 15, p. 409, pl. 15, 1907.

Occurrence.—Both sexes very abundant in Bournes Pond, Falmouth; Great Pond or Chequaket Lake, Barnstable; Shallow Pond, Barnstable; Seymour or Bangs Pond, Brewster; Crockers Pond, Falmouth; Ice Pond, Quisset, Falmouth; Jones Pond, Waquoit, Falmouth; Long Pond, Brewster; Hinckleys Pond, Harwich; Jenkins Pond, Falmouth; less abundant in Crescent Lake, Centerville, Barnstable; Mashpee Pond, Mashpee; Flax Pond, Falmouth; Browns Pond, Falmouth; Sidleys Pond, Falmouth; Salt Pond, Falmouth.

Distribution.—Oregon (Lilljeborg); Wisconsin, Michigan (Marsh); Minnesota (Herrick); Iowa, Illinois, Indiana (Schacht); Northwest Territories (Marsh); eastern Massachusetts (Pearse); Great Lakes (Marsh); Ontario, New Brunswick (Klugh).

Color.—Body clear and as transparent as glass, except around the mouth; here in some individuals there was a faint wash of red; again the red formed a narrow circle, or a small patch, and rarely covered much of the ventral surface of the head; eye ruby red, the lenses scintillating like diamonds; in other specimens the ventral patch was blue next to the mouth, and outside of this brownish or reddish; ovaries, oviducts, and eggs pale olive-green.

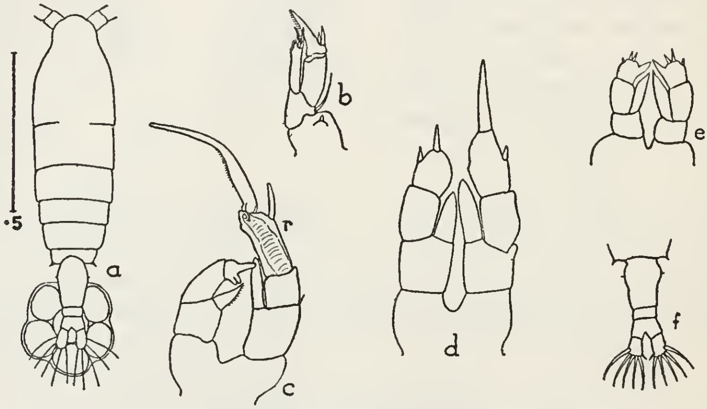

FIGURE 67.—*Diaptomus oregonensis: a,* Female, dorsal, showing number and arrangement of eggs in single egg-case; *b,* female, fifth leg; *c,* male, fifth legs; *d,* young male, fifth legs; *e,* young female, fifth legs; *f,* female, ventral view of urosome

Female.—Metasome very slender; posterior corners of fifth segment short, each with a single spine; genital segment enlarged anteriorly, with a minute spine on each lateral margin at the center of the enlargement; spines on first basipods of fifth legs minute; setae on second basipods three-fourths as long as first exopod segment; hook on second exopod segment acuminate and fringed with cilia on the inner margin; endopods 1-segmented, longer than the first exopod segment, with two equal apical setae and an inner process. Total length, 1.25–1.5 mm.

Male.—Posterior corners of fifth segment rounded, without spines; second basipods of fifth legs longer than wide; endopod of right fifth leg reaching middle of second exopod segment and unarmed; first exopod segment wider than long, second segment twice as long as wide, with an angular process at the inner distal corner and a spine at the outer corner; terminal claw twice as long as second segment, setose at the center of the inner margin; left endopod triangular, as long as first exopod segment; second exopod segment produced into two processes at the tip, the outer one fingerlike, the inner one wider and bifid. Total length, 1.25–1.4 mm.

Development stages.—In the undeveloped female the endopods of the fifth legs are as long as the entire exopod, pointed at the end without spines or setae; the first exopod segment is but little longer than the second and no wider; the second segment carries a large spine on the inner margin, two smaller ones at the tip, and a tiny one on the outer margin. In the undeveloped male the left leg is almost as long as the right; each endopod is very stout, cylindrical, and longer than the first segment of the exopod; the two segments of each exopod are about equal in length, the end segment armed with a long straight terminal spine and a much shorter one on the outer margin.

Remarks.—A ripe female carries usually six eggs, one in the center and the other five in a circle around it, all in the same plane. This species is extremely abundant in some of the first lakes mentioned above, thousands being obtained in a single haul of the net. According to Marsh it is one of the most widely distributed North American species, and may be recognized by the form of the fifth legs.

Genus PSEUDODIAPTOMUS Herrick, 1884

Head fused with or separated from the first segment; posterior corners of fifth segment rounded, fringed with hairs in the female, naked in the male; caudal rami at least two and one-half times as long as wide; genital segment of female considerably swollen, with patches of spines and bristles arranged asymmetrically; rami of first four pairs of legs 3-segmented; fifth legs uniramose in female; right fifth leg in male uniramose, left biramose; female with two egg sacks, the right one much smaller than the left, rarely lacking. A single species.

PSEUDODIAPTOMUS CORONATUS Williams

Figure 68

Pseudodiaptomus coronatus Williams, Amer. Nat., vol. 40, p. 641, figs. 1–7, 1906.

Occurrence.—One hundred males and females, surface tow, Woods Hole Harbor, September, 1882; 10 males and females, surface tow, Cuttyhunk Harbor, July, 1925; 2 males, surface tow, pond No. 2, Chappaquiddick Island, July, 1926; 150, both sexes, surface tow, Gosnold Pond, Cuttyhunk Island, July, 1926; 6 males and females, surface tow, Great Pond, Falmouth, July, 1925; 1 female, Great Pond, Barnstable.

Distribution.—Narragansett Bay (Williams); Woods Hole (Sharpe, Fish); Nova Scotia (Willey); Chesapeake Bay (Wilson).

Color.—Body a dingy white, sometimes continuous, sometimes with a colorless band across the center; in formalin the females become blue, especially around the digestive canal and the bases of the appendages, and the abdomen is spotted with small blue dots, but the eggs become orange.

Female.—Head separated from first segment and fifth segment from the fourth; urosome 4-segmented, more or less asymmetrical; genital segment protruding ventrally, with a pair of spatulate flaps over the genital aperture; first abdominal segment with a depression on the left side, filled with stout bristles; caudal rami five times as long as wide, slightly asymmetrical; fifth legs 4-segmented, each tipped with a curved spine denticulate on the inner margin, and at its base on the inside a toothed lamella; two ovisacs, the right one containing only two eggs, sometimes entirely lacking. Total length, 1.25–1.5 mm.

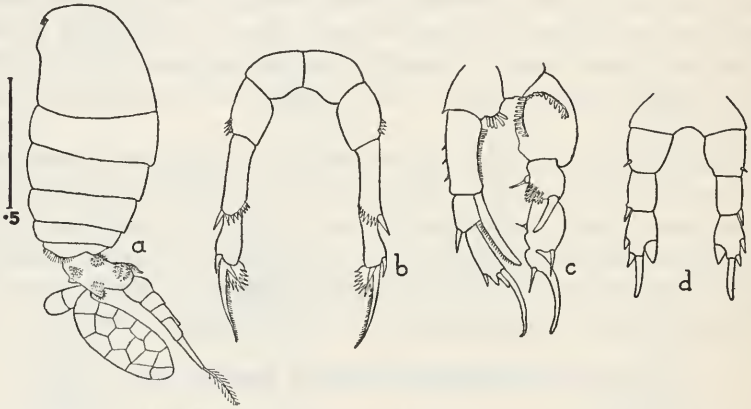

FIGURE 68.—*Pseudodiaptomus coronatus: a,* Female, lateral, showing inequality of the two egg-cases; *b,* female, fifth legs; *c,* male, fifth legs; *d,* young male, fifth legs

Male.—Body shorter and more slender; urosome 5-segmented, symmetrical; genital segment with a fringe of setae along the dorsal posterior margin and a semicircle of setae on the ventral surface; abdominal segments with triangular spines on their posterior margins; right fifth leg uniramose, 4-segmented, tipped with a curved claw and a stout plumose seta; left leg biramose, first basipod segment with a cluster of finger spines on its inner margin, second segment with a fringe of coarse teeth; left endopod a flattened blade, 1-segmented, as long as the 2-segmented exopod, which is tipped with four spines. Total length, 1–1.25 mm.

Remarks.—This is a salt- or brackish-water species, easily recognized by the caudal rami and the fifth legs, and the asymmetry in the female. Its presence in Barnstable Great Pond is a notable exception to the regular distribution, but that pond also contains other exceptions.

Family TEMORIDAE

Genus TEMORA Baird, 1850

Body short and compact; fourth and fifth segments fused; genital segment flattened ventrally; caudal rami much elongated, sometimes asymmetrical; urosome 3- or 4-segmented in the female, 5-segmented in male; endopods of first four pairs of legs 2-segmented; first exopods 3-segmented, second, third, and fourth exopods 2-segmented, terminal spines coarsely toothed; fifth legs of female uniramose, 3-segmented, symmetrical; left leg of male biramose, exopod 2-segmented, endopod 1-segmented, nearly as long as the exopod and forming with it a chela; right leg of male uniramose and 3-segmented.

KEY TO THE SPECIES

FEMALES

1. Posterior corners of fifth segment with stout acuminate spines; caudal rami symmetrical, six times as long as wide---- **stylifera** (p. 104)
   Posterior corners of fifth segment smoothly rounded, without spines -- 2
2. Anal segment longer than penultimate segment; caudal rami symmetrical, nine times as long as wide; no caudal seta widened-- **longicornis** (p. 105)
   Anal segment shorter than penultimate segment; caudal rami seven times as long as wide, right one longer than left, 1 seta widened-- **turbinata** (p. 106)

MALES

1. End segment of left fifth exopod greatly swollen, subspherical; terminal claw of right fifth leg as long as leg itself----- **stylifera** (p. 104)
   End segment of left fifth exopod not swollen; terminal claw of right fifth leg shorter even than second segment of leg itself------------ 2
2. Distal segment of left fifth exopod a little wider than basal segment, with 2 stout equal apical spines---------------- **turbinata** (p. 106)
   Distal segment of left fifth exopod narrower than basal segment, with 1 short apical spine and a much longer slender seta-- **longicornis** (p. 105)

TEMORA STYLIFERA (Dana)

Figure 69

Calanus stylifer Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 13, 1849.
Temora stylifera Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, p. 328, pls. 5, 17, 38, 1892.

Occurrence.—Twenty-five males and females in surface tows, Stations 2038, 2204, *Albatross;* 15 males and females from trawl wings, Stations 2194, 2195, 2235, 2710, *Albatross*, south of Nantucket and Marthas Vineyard.

Distribution.—Sulu Sea (Dana); Philippines, Fiji Islands (Brady); tropical Pacific, Red Sea, Mediterranean (Giesbrecht); Arabian Sea, Malay Archipelago (Cleve); off Rio de Janeiro (Dana); tropical Atlantic (Brady, Cleve); Canary Islands, Malta (Thompson); Azores (Barrois); Trieste (Car); Gulf of Maine (Bigelow).

Color.—Body fairly transparent, with yellow pigment in varying degrees in the metasome, especially a large spot on either side of the head; legs also often yellow. The pigment is arranged in a network, and on the dorsal surface of the head is mixed with meshes of bright blue. Isolated flecks of orange-red are found around the mouth and between the bases of the legs. The anterior intestine is a muddy yellowish green, the ripe eggs are bluish green, and the vulva is a dull green (Rathbun).

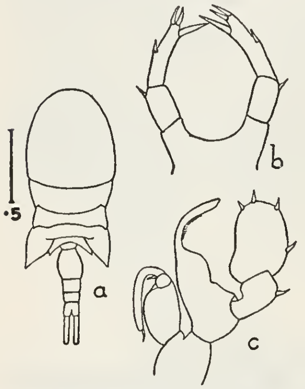

Figure 69.—*Temora stylifera:* *a*, Female, dorsal; *b*, female, fifth legs; *c*, male, fifth legs

Female.—Posterior corners of fifth segment projecting backward as broad, triangular, acuminate processes; caudal rami symmetrical, six times as long as wide, the outer seta near the center of the lateral margin; the inner spine of the end segment of the fifth legs is much longer than the two apical spines, which are about equal in size. Total length, 1.45–1.75 mm.

Male.—Spines at posterior corners of fifth segment straight and reaching behind the posterior margin of the genital segment; exopod of second leg on the left side 2-segmented, on the right side 3-segmented; terminal segment of left fifth exopod swollen into a subspherical lamina, twice the width of the basal segment; proximal portion of endopod also greatly swollen, distal portion abruptly narrowed and falciform; terminal claw on right leg bent back against the outside of the leg, and fully as long as the latter. Total length, 1.35–1.55 mm.

Remarks.—The sharp-pointed triangular processes at the corners of the fifth segment, combined with the elongate and slender caudal rami, are the distinguishing characters of this species. It evidently frequents the bottom of the ocean as much as the surface, and will probably be found much nearer the shore than any of the stations here recorded.

TEMORA LONGICORNIS (Müller)

FIGURE 70

Cyclops longicornis MÜLLER, Entomostraca, p. 115, pl. 19, figs. 7–9, 1785.
Temora longicornis SARS, Crustacea of Norway, vol. 4, p. 97, pls. 65–66, 1902.

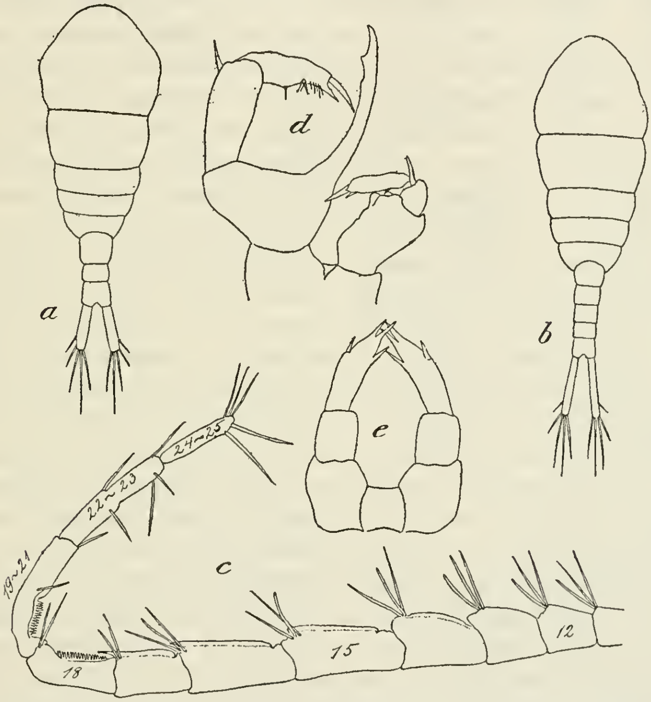

FIGURE 70.—*Temora longicornis: a,* Female, dorsal; *b,* male, dorsal; *c,* male, right first antenna; *d,* male, fifth legs; *e,* female, fifth legs. (From W. M. Wheeler)

Occurrence.—One hundred and fifty males and females in surface tows on Georges Bank, September, 1872; 200 males and females in surface tows on Georges Bank, September, 1874; 10 males and females in surface tow, Newport Harbor, 1880; 4 males and females, Woods Hole Harbor, August, 1883; 65 males and females, surface tows, Stations 2101, 2194, *Albatross;* 150 males and females, surface tows, Stations 567, 568, *Grampus.* Rathbun's manuscript contains the following statement: "Vinal Edwards collected a pint of these copepods off the railroad wharf at Woods Hole, June 22, 1882, with a fine dipnet. They were in schools at the surface."

Distribution.—British Isles (Brady); coast of France (Canu); Iceland and Shetland Islands (Cleve); Baltic (Giesbrecht); northern

Atlantic, Skager Rak (Cleve); Narragansett Bay (Williams); Gulf of Maine (Bigelow); Nova Scotia (Willey); Woods Hole (Wheeler, Fish); Chesapeake Bay (Wilson).

Color.—Body transparent, with a faint bluish tinge; on the dorsal surface of the metasome over the mouth, and on the ventral surface between the mouth parts and between the bases of the swimming legs, may usually be found small patches of a light brown or reddish brown.

Female.—Metasome obovate, widest at about the center of the head, tapering rapidly backward; corners of fifth segment smoothly rounded; urosome about half as long as metasome; genital and anal segments equal in length, basal abdominal segment shorter; caudal rami symmetrical, nine times as long as wide, ciliated on their inner margins, the outer setae halfway between the center and the tip; inner spine of end segment of fifth legs shorter than the two apical spines, which are subequal in length. Total length, 1–1.5 mm.

Male.—Urosome much longer and narrower than in the female; none of the caudal setae enlarged at their base; corners of fifth segment smoothly rounded; terminal segment of left fifth exopod narrower than the basal segment, tipped with a short spine and a long seta; endopod but little enlarged at the base and nearly straight; terminal segment of right fifth leg turned abruptly inward at a right angle near its base and armed with a strong spine on its posterior surface; apical claw short and stout. Total length, 1–1.35 mm.

Remarks.—This is one of the most common calanoid copepods around Woods Hole and often swarms in immense schools at the surface, such as the one from which Edwards obtained his pint of specimens. Fish recorded that in Woods Hole Harbor during winter this copepod formed the greater part of the plankton, while in fall and spring hardly an adult was found. They appear in greatest numbers in March and February, and are hence of much economic value. The fact that all the specimens in the United States National Museum were captured at the surface, and that Rathbun in his extensive collecting did not obtain even a single specimen in the trawl wings, emphasizes the testimony of various collectors that this is a surface species.

TEMORA TURBINATA (Dana)

FIGURE 71

Calanus turbinatus DANA, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 12, 1849.
Temora turbinata GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 329, pls. 17, 38, 1892.

Occurrence.—Six females from a surface tow on Georges Bank, September, 1872.

Distribution.—Sulu Sea (Dana); Hong Kong, Amoy (Giesbrecht); tropical Atlantic (Cleve); New Zealand (Krämer); Gulf of Guinea (T. Scott); Gulf of Maine (Bigelow).

Color.—No statement with reference to the color has ever been made.

Female.—Urosome relatively shorter and more slender than in the preceding species; anal segment shorter than the first abdominal segment and somewhat asymmetrical; caudal rami seven times as long as wide, the right one a little longer than the left; the second inner terminal seta of each ramus enlarged at the base; the inner and outer marginal spines on the terminal segment of the fifth legs much shorter and weaker than the 2 apical spines, of which the inner is considerably the longer. Total length, 1.4–1.6 mm.

Male.—Anal segment and caudal rami symmetrical, and the bases of the apical setae not enlarged; terminal segment of left fifth exopod a little wider than the basal segment and somewhat enlarged and bluntly rounded distally, the 2 apical spines stout and subequal; endopod slender, slightly curved and reaching the tip of the exopod; terminal segment of right leg short, wide, and curved inward, apical claw as long as the segment. Total length, 1.3–1.5 mm.

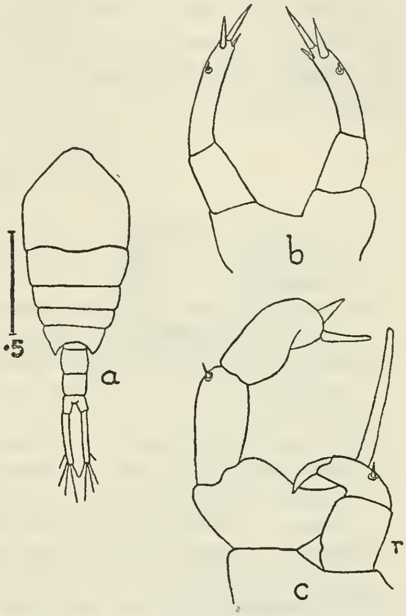

FIGURE 71.—*Temora turbinata: a,* Female, dorsal (after Giesbrecht); *b,* female, fifth legs; *c,* male, fifth legs

Remarks.—This is a rare species and does not occur in sufficient numbers to make it of any economic value. It is present in abundance in the plankton of Chesapeake Bay and vicinity, but is only a straggler from the south in the Woods Hole area. It can be most easily recognized by the well-marked difference in the size and form of the fifth legs in both sexes.

Genus EURYTEMORA Giesbrecht, 1881

Metasome elliptical, head separated from first segment, and fifth segment from the fourth, the posterior corners with large winglike processes in the female, smoothly rounded in the male; urosome 3-segmented in female, 4- or 5-segmented in male; caudal rami symmetrical and elongated; exopods of first four pairs of legs 3-segmented; endopod of first leg 1-segmented, of second, third, and fourth legs 2-segmented; fifth legs uniramose and 4- or 5-segmented in both sexes.

Remarks.—This genus is peculiar in that it frequents water showing every degree of salinity, from that of the ocean to absolutely fresh water. One or two species are apparently confined to a certain degree of salinity, but by far the larger number seem capable of adapting themselves to salt, brackish, or fresh water indiscriminately.

KEY TO THE SPECIES

FEMALES

1. Upper surface of caudal rami and anal segment covered with short spines or hairs; terminal segment of fifth legs subglobular ---------- 2
No hairs or spines on dorsal surface of anal segment; terminal setae of each fifth leg unequal in length and stout ---------- 4
2. Fifth legs tipped with 2 exceptionally long, equal, plumose setae; inner margin of 2 distal segments fringed with long hairs ---------- **americana** (p. 109)
Fifth leg tipped with 2 nonplumose spines, inner one three times as long as outer; no hairs on distal segments ---------- 3
3. Posterior corners of fifth segment turned backward; penultimate segment of fifth legs with 2 spines on outer margin ---------- **hirundoides** (p. 110)
Posterior corners of fifth segment turned outward; penultimate segment of fifth legs with 3 spines on outer margin ---------- **affinis** (p. 111)
4. Fifth segment with pointed processes at posterior corners; penultimate segment of fifth legs six times as long as wide ---------- **herdmani** (p. 112)
Fifth segment with rounded posterior corners; penultimate segment of fifth legs as wide as long or wider ---------- **lacustris** (p. 114)

MALES

1. Right fifth leg 4-segmented, the 2 distal segments being fused ---------- 2
Right fifth leg 5-segmented, the 2 distal segments distinctly separated ---------- 3
2. Second (basipod) segment of right fifth leg as long as third segment (first exopod); end segment with 1 outer and 2 inner spines ---------- **hirundoides** (p. 110)
Second (basipod) segment of right fifth leg much shorter than third segment; end segment with no outer and 4 inner spines ---------- **lacustris** (p. 114)
3. Fourth segment of each fifth leg four or five times as long as end segment; end segment of left leg much wider than long ---------- **americana** (p. 109)
End segment of each fifth leg longer than preceding segment; left fifth leg 4-segmented, the 2 distal segments fused ---------- 4

4. Third (first exopod) segment of right fifth leg much longer than fourth and fifth segments combined; second segment of left leg without spines ---------- herdmani (p. 112)
   Third (first exopod) segment of right fifth leg no longer than fourth and fifth segments combined; second segment of left leg with 2 outer spines ---------- affinis (p. 111)

EURYTEMORA AMERICANA Williams

FIGURE 72

Eurytemora americana WILLIAMS, Amer. Nat., vol. 40, p. 645, figs. 8–11, 1906.

Occurrence.—A dozen males in surface tow at Menemsha Bight, Marthas Vineyard, August, 1926.

Distribution.—Narragansett Bay (Williams).

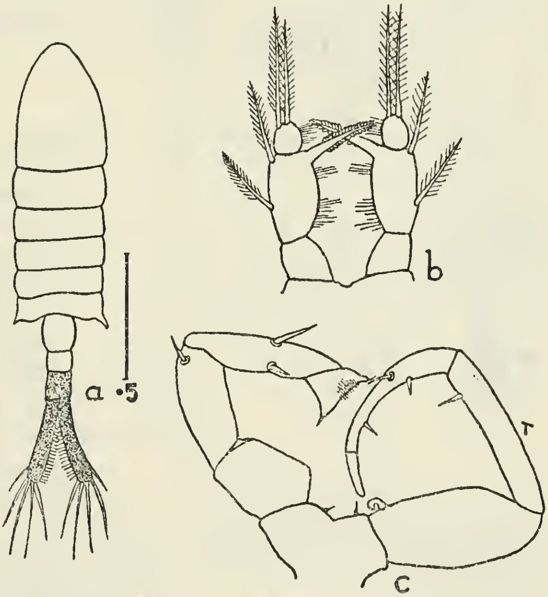

FIGURE 72.—*Eurytemora americana: a,* Female, dorsal; *b,* female, fifth legs; *c,* male, fifth legs

Color.—Body transparent and colorless, the anal segment and caudal rami appearing dark colored on account of the spines covering their dorsal surface; eye ruby red; eggs light green.

Female. — Posterior angles of fifth segment armed with sharp spines directed diagonally outward and backward; urosome, including the caudal rami, three-fifths as long as metasome; genital segment evenly rounded laterally and dorsally, but protruding ventrally; caudal rami as long as urosome, eight times as long as wide, and together with the anal segment covered with small spines; basal segments of fifth legs completely fused, leaving three free segments in each leg; end segment tipped with two very long and slender plumose setae; inner spine of penultimate segment long, acuminate, dentate distally; inner margins of these two segments fringed with tufts of long hairs. Total length, 1.6–1.85 mm.

Male.—Posterior angles of fifth segment smoothly rounded, no spines; urosome 5-segmented, anal segment and caudal rami without spines on their dorsal surface; caudal rami often only six times as long as wide and not curved; both fifth legs 5-segmented, fourth segment four times as long as fifth; end segment of left leg tipped with two lobes, each armed with a small spine. Total length, 0.75–0.95 mm.

Remarks.—Williams gave January to April as the season for this species in Narragansett Bay, and summer in Charlestown Pond, a brackish inlet from the ocean. There is every reason to believe it will be found somewhere in Buzzards Bay or in some of the brackish-water ponds around Woods Hole. It can be recognized by the spiny covering of the anal segment and caudal rami, and by the form of the fifth legs.

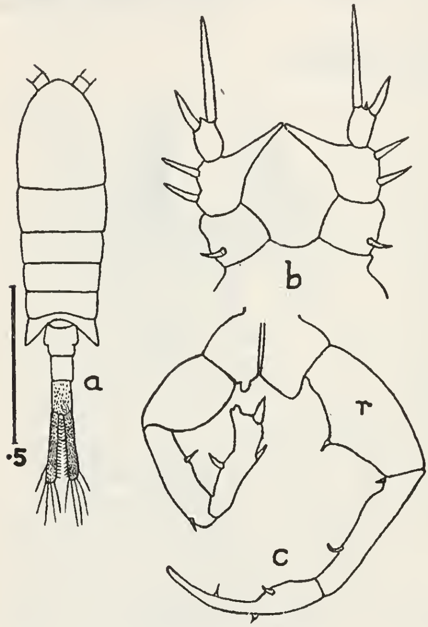

FIGURE 73.—*Eurytemora hirundoides: a,* Female, dorsal; *b,* female, fifth legs; *c,* male, fifth legs

EURYTEMORA HIRUNDOIDES (Nordquist)

FIGURE 73

Temorella affinis var. *hirundoides* NORDQUIST, Die Calaniden Finlands, p. 48, pl. 4, figs. 5–11, pl. 5, fig. 5, 1888.

Eurytemora hirundoides SARS, Crustacea of Norway, vol. 4, p. 102, pl. 69, 1902.

Occurrence.—One female in surface tow in Woods Hole Harbor, September, 1881; both sexes abundant in Salt Pond, Falmouth; Oak Bluffs Pond, Marthas Vineyard; Oyster Pond, Falmouth; Quisset Pond, Falmouth; Farm Pond, Marthas Vineyard; Poucha Pond, Chappaquiddick Island; Waquoit Bay, Falmouth; Edgertown Great Pond, Marthas Vineyard; West End Pond, French Watering Place and Tarpaulin Cove Pond, on Naushon Island; found in small numbers in Gosnold Pond, Cuttyhunk Island; Ponds Nos. 1 and 2, Chappaquiddick Island; John Pond, Mashpee.

Distribution.—Norwegian coast (Sars); Scania (Lilljeborg); Finnish coast (Nordquist); Nova Scotia (Willey); Narragansett Bay (Williams); Chesapeake Bay (Wilson); Woods Hole (Sharpe, Fish).

Color.—Body transparent and colorless; ovaries and oviducts in the ripe female yellowish olive and opaque; tips of the rami and setae of the swimming legs olive to rusty brown; eye ruby red. In the male the only color is in the longitudinal muscles, which are tinged faintly with olive, and in the rami of the swimming legs, which are colored like those of the female.

Female.—Body slender, the greatest width about one-fifth of the length; posterior corners of the fifth segment expanded into triangular lamellae; genital segment abruptly contracted just behind the center; anal segment longer than the genital segment and, with the caudal rami, covered on the dorsal surface with scattered spines; terminal spines on the fifth legs smooth, the inner ones two or three times as long as the outer; penultimate segment with two stout spines on the outer margin and a wide triangular spine at the inner distal corner, all smooth. Total length, 1–1.25 mm.

Male.—Posterior corners of fifth segment smoothly rounded; urosome, including the caudal rami nearly as long as the metasome, 5-segmented; fifth legs each 4-segmented, the second (basipod) segment considerably swollen; end segment of right leg swollen at its base, of left leg at its tip, where it ends in two or three knobs, each armed with a spine. Total length, 0.9–1 mm.

Remarks.—As can be seen above, this species is well distributed among the brackish and fresh ponds of the area, in some of which it was obtained in considerable abundance. It is readily distinguished from the other species of the genus by the dorsal spines on the anal segment and the caudal rami, and by the form of the fifth legs, especially those of the male, in each of which the two distal segments are completely fused.

EURYTEMORA AFFINIS (Poppe)

FIGURE 74

Temora affinis POPPE, Abh. Nat. Ver. Bremen, vol. 7, pt. 1, p. 55, pl. 3, 1880.—GIESBRECHT and SCHMEIL, Das Tierreich, Lief. 6, Copepoda, p. 103, 1898.

Occurrence.—Two females from a surface tow in Poucha Pond, Chappaquiddick Island, July, 1926.

Distribution.—Germany, Austria (Poppe); Sweden (Nordquist); England, Scotland (Scourfield, Brady); Caspian Sea (De Guerne and Richard); France (Richard, Canu); Gulf of St. Lawrence (Giesbrecht); rivers and estuaries of Gulf of Mexico (Herrick); Squam Pond, Nantucket Island (Pearse).

Color.—Body transparent with an intensive admixture of violet, blue, red, and yellow without definite arrangement. The basal segments of the legs, the mouth parts, the margins of the metasome segments and the caudal rami show one or more of these colors. Sometimes the first antennae are colored a dark blue as far as the twelfth segment. Specimens obtained during summer show internally a large number of red oil drops.

Female.—Head separated from the first segment; posterior corners of fifth segment produced into triangular wings, each tipped with a small spine; genital segment no wider than the abdomen; caudal rami as long as the two abdominal segments combined, and with the anal segment covered dorsally with small spines; second (basipod) segment of fifth legs wider than long, third segment with three spines on the outer margin, increasing in size distally, and a broad spine at the inner distal corner, which is diagonal to the long axis of the segment. Total length, 1.4–1.6 mm.

Male.—Urosome 4-segmented, the third segment much the shortest; posterior corners of the metasome smoothly rounded; right fifth leg 5-segmented, left leg 4-segmented; second and third segments of right leg equal in length, each with a process on the inner margin carrying a spine; fifth segment much longer and narrower than the fourth; second segment of left leg triangular, with two spines on the outer margin; fourth segment enlarged toward the tip, where it ends in three processes, each armed with a short seta. Total length, 1.4–1.6 mm.

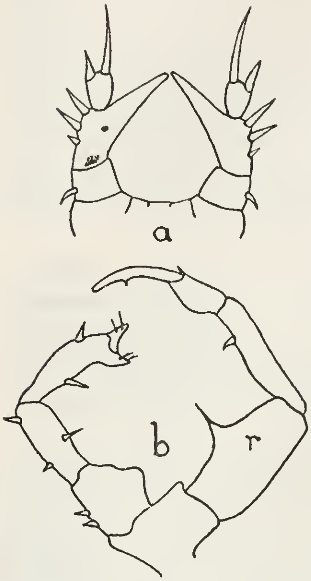

FIGURE 74.—*Eurytemora affinis:* *a*, Female, fifth legs; *b*, male. fifth legs

Remarks.—Poppe noted that this species is not confined to salt water but ascends rivers and estuaries into brackish water, and through this to water that is perfectly fresh. It is likely to be found therefore in any of the brackish ponds of the Woods Hole region upon further examination. It may be recognized by the dorsal spines covering the anal segment and the caudal rami, and by the details of the fifth legs, especially of the female.

EURYTEMORA HERDMANI Thompson and Scott

FIGURE 75

Eurytemora herdmani THOMPSON and SCOTT, Proc. Liverpool Biol. Soc., vol. 12, p. 78, pl. 5, figs. 1–11, 1897.—GIESBRECHT and SCHMEIL, Das Tierreich, Lief. 6, Copepoda, p. 103, 1898.

Occurrence.—Two females were taken in a surface tow in Woods Hole Harbor, September, 1881; 40 males and females, surface tow, Woods Hole Harbor, July, 1925; 5 females, surface tow, Cuttyhunk Harbor, July, 1925.

Distribution.—St. Lawrence River (Thompson and Scott); Gulf of Maine (Bigelow); Narragansett Bay (Williams); Woods Hole (Sharpe, Fish).

Color.—Body of female in general transparent, the ovaries and oviducts bluish black as far back as the posterior margin of the third segment. This black extends out on either side along the grooves between the segments to the lateral margins. Fourth and fifth segments, including the large wings at the posterior corners, entirely transparent. Posterior portion of genital segment and first abdominal segment with a faint wash of brown; anal segment blue, deepest along the lateral margins and extending onto the bases of the caudal rami. Eye dark reddish brown, with a blue crescent-shaped spot behind it around the anterior end of the stomach. Exopods of first and second legs flecked with black.

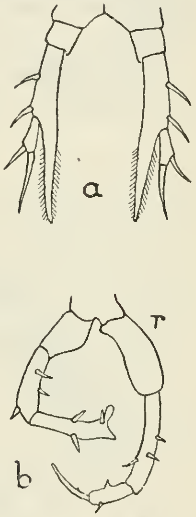

FIGURE 75.—*Eurytemora herdmani: a*, Female, fifth legs; *b*, fifth legs

Male also transparent, the blue of the bases of the mouth parts extending onto the ventral surface and around the anterior end of the stomach. A narrow reddish-brown line extends along the groove between the head and first segment on the sides of the body, and there is an elongated spot of the same color on either side of the intestine in the fourth and fifth segments. The thickened portion of the grasping antenna is bright brick red (Rathbun).

Female.—Posterior corners of fifth segment with very large sharp-pointed processes, reaching beyond the posterior margin of the genital segment; the latter is swollen into a knob on each side near the distal end; second (basipod) segment of fifth legs as wide as long and unarmed; penultimate segment with two small spines on the outer margin, the large spine at the inner distal corner as long as the segment itself, parallel with the axis of the leg, and setose on both margins distally; end segment narrow, with two apical spines, the inner one twice as long as the outer. Total length, 1.3–1.6 mm.

Male.—Body more slender, the posterior corners of the fifth segment smoothly rounded, and the genital segment without lateral knobs; second (basipod) segment of left fifth leg swollen but little, terminal segment enlarged distally and ending in two rounded knobs; right fifth leg distinctly 5-segmented, the third segment longer and much narrower than the second, the terminal segment filiform and a little longer than the penultimate segment. Total length, 1.2–1.5 mm.

Remarks.—Fish found this species in Woods Hole Harbor from February to August, and it is probably well distributed throughout the area. The winglike processes at the corners of the fifth segment and the form of the fifth legs, especially in the female, are the chief distinctive characters.

EURYTEMORA LACUSTRIS (Poppe)

Figure 76

Temorella lacustris Poppe, Zeitschr. Wiss. Zool., vol. 45, p. 278, pl. 15, figs. 10–13, 1887.

Eurytemora lacustris Sars, Crustacea of Norway, vol. 4, p. 103, pl. 70, 1902.

Occurrence.—Both sexes found in abundance in surface tows in Quisset Pond, Falmouth; Poucha Pond and Pond No. 1, Chappaquiddick Island; Oyster Pond, Falmouth and Gosnold Upper Pond, Cuttyhunk Island; found in small numbers in Farm Pond, Marthas Vineyard; John Pond, Mashpee; Oak Bluffs Pond, Marthas Vineyard.

Distribution.—Sweden (Lilljeborg); Germany (Poppe); Finland (Nordquist); Ladoga (Nordquist); Norway (Sars).

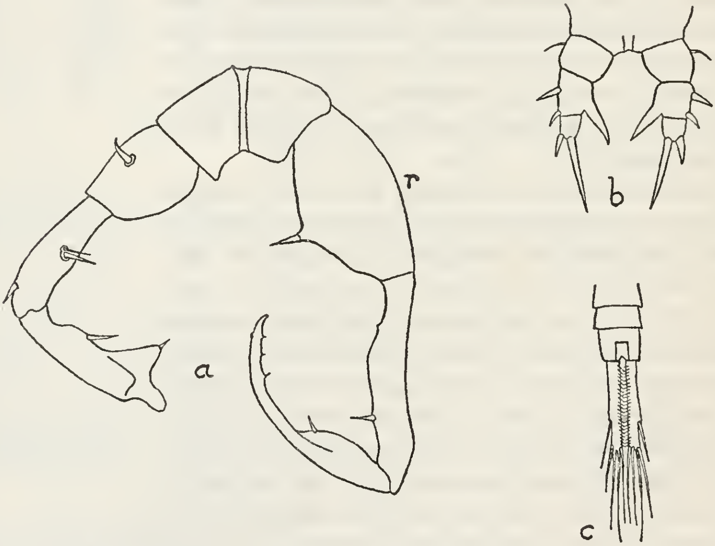

Figure 76.—*Eurytemora lacustris: a,* Male, fifth legs; *b,* female, fifth legs; *c,* female, abdomen and caudal rami

Color.—Both sexes are highly transparent and practically colorless, and hence very difficult to detect in a dish of water.

Female.—Head separated from first segment, with a slight cervical depression on the dorsal surface; fifth segment with rounded corners; genital segment slightly dilated through the center, its lateral margins sparsely setose; anal segment and caudal rami without dorsal spines; second (basipod) segment of fifth legs wider than long, with an outer seta; third segment very short, no longer than wide, with two small outer, and a slender inner spine; inner apical spine of end segment four times as long as outer. Total length, 1.2–1.4 mm.

Male.—Fifth segment smoothly rounded at the posterior corners; grasping antenna considerably swollen; second segment of right fifth leg dilated through the center, with a prominent papilla, tipped with a spine, on the inner margin; third segment slender, longer than any of the others, with a sinuous inner margin; end segment swollen basally, slender distally, with three tiny inner spines; end segment of left leg longer than penultimate segment, enlarged at the tip, with a rounded process at each corner. Total length, 1.1–1.3 mm.

Remarks.—The absence of processes at the corners of the fifth segment, the smooth dorsal surface of the anal segment and caudal rami, and the relative proportions of the segments in the fifth legs are the distinctive characters. Sars said of this species in Europe that it was found only in fresh water, but here in the Woods Hole area some of the ponds mentioned above are quite brackish.

Genus EPISCHURA Forbes, 1882

Head with a distinct cervical depression; fourth and fifth segments more or less completely fused, with rounded posterior corners; urosome 4-segmented in female, 5-segmented in male; caudal rami each with three large setae; abdomen of male with prehensile appendages and usually distorted to the right; endopods of first four pairs of legs 1-segmented, exopods 3-segmented; fifth legs uniramose, 3-segmented in female; in male right fifth leg biramose, left uniramose.

Remarks.—Only one species has been found in the present area, but further examination of the lakes and ponds will very likely reveal another species, and so the distinction between the two is here given.

KEY TO THE SPECIES

FEMALES

1. Abdomen distinctly flexed to right; external seta of each caudal ramus much larger than other two---------------------------- lacustris
Abdomen symmetrical, not flexed to right; the 3 setae on each caudal ramus all the same size---------------------- nevadensis (p. 115)

MALES

1. First abdominal segment much longer than genital segment, with a long, straight, triangular process on right side---------- lacustris
First abdominal segment no longer than genital segment, its process winglike, toothed on posterior margin and hooked at tip--- nevadensis (p. 115)

EPISCHURA NEVADENSIS Lilljeborg

FIGURE 77

Epischura nevadensis LILLJEBORG, Mém. Soc. Zool. France, vol. 2, p. 145, pl. 2, figs. 12, 24, pl. 3, fig. 21, 1889.—GIESBRECHT and SCHMEIL, Das Tierreich, Lief. 6, Copepoda, p. 99, 1898.

Occurrence.—Both sexes found in abundance in a small lily pond south of Ashumet Pond, Falmouth; Crockers Pond, Falmouth;

Upper, Middle, and Lower Cotuit Ponds, Barnstable; Long Pond, Barnstable; pond beside State road in East Falmouth; Crescent Lake, Centerville, Barnstable; Ice Pond, Quisset, Falmouth; Flax Pond, Falmouth; West End Pond, Naushon Island; Flax Pond between North and South Pocasset in Bourne; Red Brook Pond, Bourne; found in small numbers in Clear Pond, Chatham; Great Pond, Barnstable; French Watering Place, Naushon Island.

Distribution.—Mountain lakes of Western United States (Marsh, Herrick, Forbes).

Color.—Transparent with a decided yellowish-brown tinge, deepest on the dorsal surface; bases of the swimming legs and ventral surface of the genital segment blue; eye dull red; metasome segments with a narrow blue band across their posterior margins; ovaries and oviducts brown; rami of swimming legs reddish; caudal setae bluish.

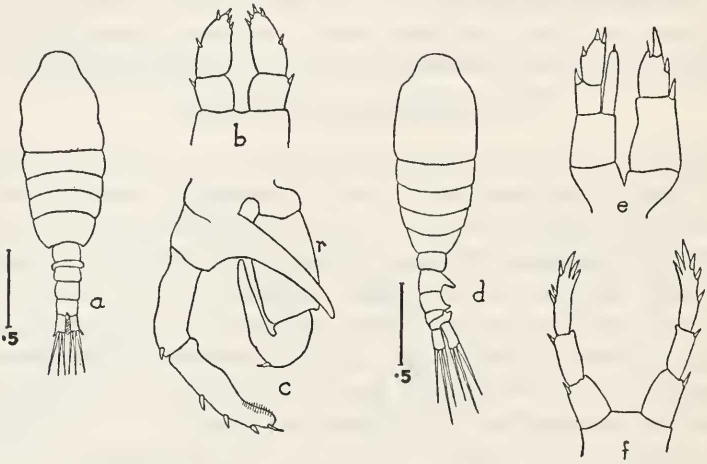

FIGURE 77.—*Epischura nevadensis:* *a,* Female, dorsal, showing peculiar spermatophore coiled around genital segment; *b,* young female, fifth legs; *c,* adult male, fifth legs; *d,* male, dorsal; *e,* young male, fifth legs; *f,* adult female, fifth legs

Female.—Head separated from the first segment; fourth and fifth segments completely fused; genital segment a little wider than the abdomen and protuberant on the ventral surface; caudal rami twice as long as wide, each with three equal apical setae and a small spine at the outer and inner corner, and a fringe of cilia along the inner margin; spermatophore elongate, cylindrical, and wrapped around the genital segment like a bracelet; segments of fifth legs increasing in length distally, the end segment with three longer apical spines and three shorter ones on the outer margin. Total length, 1.75–2 mm.

Male.—Urosome usually distorted to the right, but symmetrical in young males and sometimes in the adults; basal abdominal segment longer than the genital segment, twice as wide as long, with a large winglike process extending to the right, denticulate along its posterior margin, and hooked at its tip; third segment with a shorter process, and fifth segment with two processes, all on the right side; caudal rami asymmetrical, the right one the longer, three times as long as wide. Right fifth leg uniramose, its blunt apical claw folded back along the inside of the leg; left fifth leg biramose, the endopod a long stout claw on the inner margin of the second basipod segment, the exopod 2-segmented. Total length, 1.5–1.75 mm.

Development stages.—In young females the basal segments of the fifth legs are indistinguishably fused with each other and with the ventral surface of the fifth segment. Each leg has two free segments, short, stout, and armed with minute spines, the distal segment twice the length of the basal. In the youngest males the basal segments of the fifth legs are separated by a distinct median sinus, the right leg is 3-segmented, the second segment two-fifths longer than the third, both armed with short, stout spines; the left leg shows beyond question that it is biramose, the 1-segmented endopod and the 2-segmented exopod attached side by side to the end of the second basipod segment. In older males the right fifth leg becomes distinctly 4-segmented, indicating that the terminal portion in the adult is really two segments fused. In the left fifth leg the endopod is drawn away from the exopod, and the latter is considerably lengthened, but still 2-segmented as in the fully developed adult.

Remarks.—This copepod can be recognized most easily by the three terminal setae on each caudal ramus. This character is especially useful in separating young females from the adults of the various species of *Diaptomus* with which they are nearly always associated.

Family METRIDIIDAE

Genus METRIDIA Boeck, 1864

Body slender and elongated; head separated from the first segment; fourth and fifth segments fused, with rounded or angular corners but no processes or spines; urosome narrow and elongated, genital segment not protuberant ventrally; caudal rami truncated at the tip, the two middle apical setae enlarged and jointed near the base; rami of the first four pairs of legs 3-segmented, basal segment of second endopod deeply invaginated on the inner margin, with hamiform spines on the distal margin of the invagination; fifth legs uniramose in both sexes, 3- or 4-segmented in the female, 5-segmented in the male.

KEY TO THE SPECIES

FEMALES

1. Caudal rami twice as long as wide or less; fifth legs 3-segmented---------- 2
   Caudal rami three times as long as wide or more; fifth legs 4-segmented---------- 3
2. First antennae reaching caudal rami; fifth legs tipped with 2 setae of equal length; no spine on outer margin------ **brevicauda** (p. 118)
   First antennae only reaching genital segment; fifth legs tipped with 3 unequal setae; a small spine on outer margin----- **lucens** (p. 119)
3. Caudal rami three times as long as wide; end segment of fifth legs with 2 apical setae, and a third longer one on inner margin---------- **longa** (p. 120)
   Caudal rami five times as long as wide; end segment of fifth legs with 3 subequal apical setae, plumose only proximally---------- **princeps** (p. 122)

MALES

1. First antennae reaching caudal rami or beyond---------- 2
   First antennae not reaching beyond genital segment---------- 3
2. Grasping antenna on left side; caudal rami twice as long as wide or less; left fifth leg much longer than right---- **brevicauda** (p. 118)
   Grasping antenna on right side; caudal rami five times as long as wide, and slightly asymmetrical; fifth legs equal in length---------- **princeps** (p. 122)
3. Caudal rami twice as long as wide; end segments of fifth legs only slightly narrowed distally; left antenna geniculate-- **lucens** (p. 119)
   Caudal rami three times as long as wide; end segments of fifth legs strongly narrowed distally; right antenna geniculate- **longa** (p. 120)

METRIDIA BREVICAUDA Giesbrecht

FIGURE 78

Metridia brevicauda GIESBRECHT, Atti Accad. Lincei, Rome, ser. 4, vol. 5, sem. 2, p. 24, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, p. 340, pl. 33, 1892.

Occurrence.—Fifteen males and females taken in surface tow, Station 20115, *Grampus;* 1 female from trawl wings, Station 2236, *Albatross*, off Marthas Vineyard.

Distribution.—Tropical Pacific (Giesbrecht); South African seas (Cleve, Stebbing); North Atlantic (van Breemen); Gulf of Maine (Bigelow).

Color.—Body transparent and without pigmentation.

Female.—Metasome twice the length of the urosome; genital segment somewhat shorter than the abdomen; caudal rami less than twice as long as wide; first antennae reaching the caudal rami; end segment of fifth legs with two long, slender apical setae equal in length, the two proximal segments unarmed; anal segment with a knoblike process at each posterior corner. Total length, 2–2.25 mm.

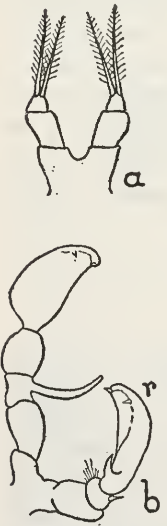

FIGURE 78.—*Metridia brevicauda: a*, Female, fifth legs; *b*, male, fifth legs

Male.—Urosome more than half the length of the metasome, 5-segmented; caudal rami less than twice as long as wide and symmetrical; first antennae as long as in the female, the left one geniculate; right fifth leg only half as long as the left, its end segment longer than the other three segments combined, with a short spine near the base, the third segment with long hairs on the inner margin; end segment of left fifth leg half as wide as long and tapered but little distally. Total length, 1.5–1.65 mm.

Remarks.—This species can be distinguished by the short caudal rami and the long first antennae and by the detailed structure of the fifth legs, especially those of the female. It is more or less of a straggler in this area.

METRIDIA LUCENS Boeck

FIGURE 79

Metridia lucens BOECK, Forh. Vid.-Selsk. Christiania, 1864, p. 238.—SARS, Crustacea of Norway, vol. 4, p. 113, pl. 77, 1902.

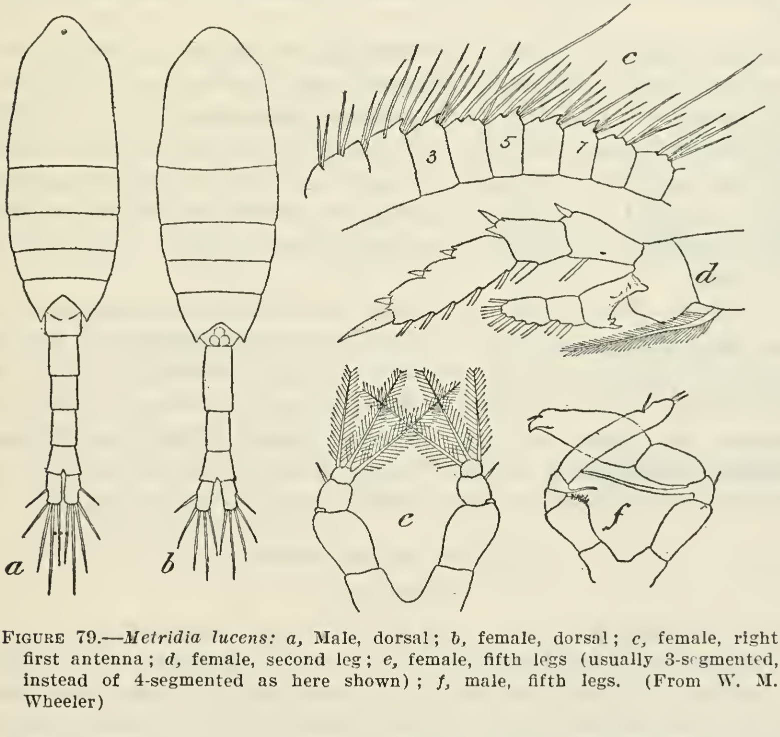

FIGURE 79.—*Metridia lucens: a,* Male, dorsal; *b,* female, dorsal; *c,* female, right first antenna; *d,* female, second leg; *e,* female, fifth legs (usually 3-segmented, instead of 4-segmented as here shown); *f,* male, fifth legs. (From W. M. Wheeler)

Occurrence.—Fifty males and females from the trawl wings, Stations 2195, 2236, 2237, *Albatross,* off Marthas Vineyard; more than 1,000, including both sexes, taken by the *Grampus* in surface tows at 20 different stations, and in vertical hauls at 60 different stations, many of them within the present area.

Distribution.—North Atlantic (Cleve); North Pacific (Giesbrecht); coast of Norway (Sars); British Isles (Brady, Scott); Mediterranean (Giesbrecht); South African seas (Cleve, Stebbing); Gulf of Suez (Thompson and Scott); North Sea, Skager Rak (Cleve); California coast (Esterly); Canadian coast (Willey); Gulf of Maine (Bigelow); Woods Hole (Wheeler, Fish).

Color.—Body transparent, with a whitish wash, so as to be visible over a dark background, but almost invisible over a light background. In alcohol the specimens assume a pure-white color without any reddish tinge (Rathbun).

Female.—Posterior corners of fifth segment angular, but without spines; urosome, including the caudal rami, two-thirds as long as the metasome; genital segment shorter than the abdomen; caudal rami about twice as long as wide; first antennae only reaching center of genital segment; end segment of fifth legs with three apical setae and a small spine on the outer margin; the inner apical seta is longest and the outer one shortest, all sparsely plumose. Total length, 2.5–3 mm.

Male.—Posterior corners of fifth segment as in the female; urosome relatively shorter and narrower; caudal rami scarcely twice as long as wide; usually the left antenna geniculate; left fifth leg a little shorter than the right, 5-segmented, the end segment longer than the rest of the leg and not tapered distally, the second segment with an inner fringe of hairs; spiniform process on inner margin of third segment of right fifth leg denticulate distally. Total length, 2–2.5 mm.

Remarks.—This is one of the three most abundant copepods of the area, and is found in greater numbers at depths between 50 and 100 meters, swimming up to the surface at night and sinking again during the day. It breeds within the area and increases regularly in numbers in spring and fall, at which times it becomes of much economic importance as fish food. The specimens referred by Wheeler to *Metridia hibernica* really belong to this species.

METRIDIA LONGA (Lubbock)

FIGURE 80

Calanus longus LUBBOCK, Ann. Mag. Nat. Hist., ser. 2, vol. 14, p. 127, pl. 5, fig. 10, 1854.—SARS, Crustacea of Norway, vol. 4, p. 112, pls. 75–76, 1902.

Occurrence.—One hundred males and females from the trawl wings, Stations 1027, 1039, 1089, *Fish Hawk*, south of Nantucket, and Stations 2195, 2236, *Albatross*, off Marthas Vineyard; four females by Rathbun in surface tow in Woods Hole Harbor, August, 1883; many hundreds obtained in surface tows at 20 *Grampus* stations, and in vertical hauls at 55 *Grampus* stations in the Gulf of Maine.

Distribution.—Arctic Ocean (Lubbock, Mrázek); Greenland (Buchholz); Spitzbergen (Lilljeborg); northern Atlantic (Cleve); Scottish seas (T. Scott); Faroe Channel (Norman); Baffin Bay (Hansen); Polar Basin (Giesbrecht); coast of Norway (Sars); Greenland (Damas and Koefoed); Alaska (Willey); Gulf of Maine (Bigelow).

Color.—Body colorless and transparent, sometimes whitish, with a small dull red spot between the bases of the first antennae in front of the eye; the latter a bright carmine-red (Rathbun).

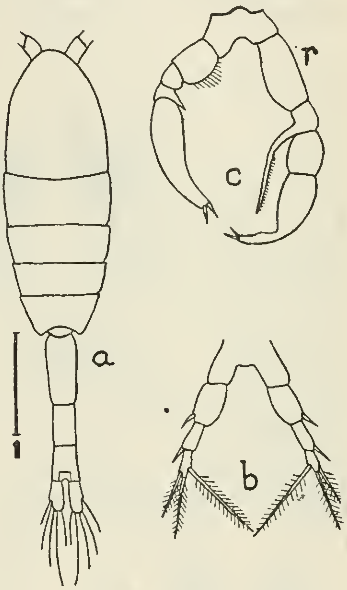

FIGURE 80.—*Metridia longa: a*, Female, dorsal (after Sars); *b*, female, fifth legs; *c*, male, fifth legs

Female.—Metasome nearly three times as long as wide, its posterior corners rounded; genital segment as long as the abdomen and protruded ventrally; caudal rami nearly three times as long as wide and somewhat broadened distally; fifth legs distinctly 4-segmented, the end segment much smaller than any of the others, with 2 unequal apical setae and a much longer one on the inner margin, all plumose; second and third segments each with an outer spine. Total length, 4–4.5 mm.

Male.—Body more slender and elongated than in the female; left antenna geniculate usually, sometimes the right one; each fifth leg 5-segmented, the right leg longer than the left, its end segment strongly narrowed distally, the spiniform process on the third segment denticulate; second segment of left leg with an inner fringe of hairs, end segment strongly tapered distally, penultimate segment with a short inner spine. Total length, 3.5–4 mm.

Remarks.—This species is nearly as abundant as the preceding and is well distributed throughout the area, which fact, together with its large size, gives it considerable economic importance. Sars, in the reference given above, said: "When disturbed, it sends out from its body a bright flash of a bluish color. This flash is so intense that even by full daylight it can easily be seen." Such a statement would seem to indicate that *longa*, as van Breemen has mentioned in his Nordisches Plankton (1908) with reference to *lucens*, is luminescent, and contributes to the phosphorescence that is so prevalent in the oceanic portions of the present area.

METRIDIA PRINCEPS Giesbrecht

FIGURE 81

Metridia princeps GIESBRECHT, Atti Accad. Lincei, Rome, ser. 4, vol. 5, sem. 2, p. 24, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, p. 340, pl. 33, 1892.

Occurrence.—One female and three males from the trawl wings, Stations 2093, 2173, 2219, 2229, *Albatross*, south of Marthas Vineyard.

Distribution.—Southern Atlantic (Thompson); tropical Pacific (Giesbrecht); California coast (Esterly); South African seas (Cleve, Stebbing); Gulf of Maine (Bigelow).

Color.—Body translucent, with a bright-red line through the center of the abdomen and the posterior portion of the thorax and a large spot of the same color at the bases of the mouth parts; no eye spot visible (Rathbun).

Female.—Metasome elliptical, considerably narrowed anteriorly; urosome two-thirds as long as metasome; genital segment longer than abdomen; caudal rami five times as long as wide; first antennae reaching beyond tips of the caudal rami; fifth legs 4-segmented, basal segment with a tuft of long hairs on the anterior surface, second segment with a stout plumose seta at the outer distal corner, end segment with three apical setae, about equal in length and plumose only proximally. Total length, 8–8.5 mm.

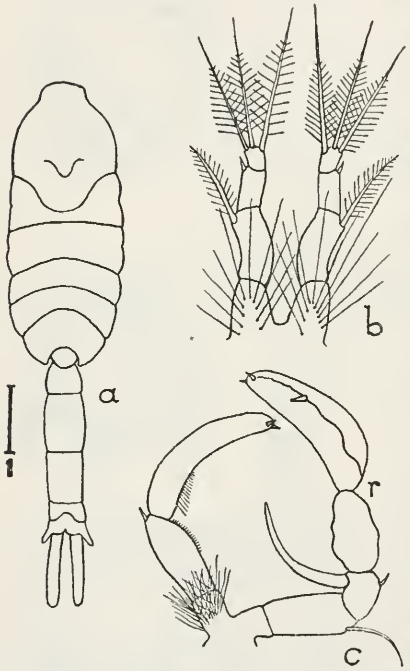

FIGURE 81.—*Metridia princeps*: *a*, Male, dorsal; *b*, female, fifth legs; *c*, male, fifth legs

Male.—Urosome four-fifths as long as metasome, anal segment extending backward on each corner in a short blunt process, outside the caudal ramus; the latter more than six times as long as wide; right fifth leg 5-segmented, the second segment with an outer seta, the spiniform process on the inner margin of the third segment smooth, the end segment considerably swollen and longer than the two preceding segments combined; left fifth leg 3-segmented, basal segment with a tuft of long hairs, second segment fringed with short hairs on the inner margin, end segment longer than the other two, about the same width throughout, and tapered only very slightly. Total length, 6–7 mm.

Remarks.—This species may be recognized by its large size, by the length and slenderness of the caudal rami, and by the details of the fifth legs in both sexes. The only previous record of the copepod on this side of the Atlantic was the single female taken by Bigelow in the Gulf of Maine and identified by the present author. The new records here presented would indicate that *princeps* is more of a bottom form than any other species of the genus.

Genus PLEUROMAMMA Giesbrecht, 1898

Body stouter and not so elongate as in *Metridia;* head either separated from, or fused with, the first segment, one of the two carrying a conspicuous knob or luminous organ on the right or left side; fourth and fifth segments fused with rounded corners; urosome 3-segmented in female, 5-segmented in male; rami of the first four pairs of legs 3-segmented; proximal segment of second endopod invaginate at the base on the inner side, with an overhanging spine; exopod of third leg with a deep sinus on the outer margin of the first segment; fifth legs uniramose.

Remarks.—Wheeler gave a diagnosis of both sexes of this genus, but mentioned no species, and gave no record of any specimens. The present material contains at least four species, so that the genus is fairly common along our shores. The genus was originally called *Pleuromma* by Claus, and that name is used by Wheeler, but the name had been preoccupied and so was changed by Giesbrecht.

KEY TO THE SPECIES

FEMALES

1. Forehead protruding in a sharp-pointed process__________ **xiphias** (p. 124)
   Forehead smoothly rounded, without a process__________________________ 2
2. Proximal segment of first antenna with several small and 2 large teeth upon its anterior margin______________ **abdominalis** (p. 125)
   Proximal segment of first antenna without teeth, large or small__________ 3
3. End segment of fifth leg armed with 3 setae, inner one longer than entire leg______________________________________ **robusta** (p. 126)
   End segment of fifth leg armed with 3 short spines, about equal in length and shorter than segment itself______________ **gracilis** (p. 127)

MALES

1. Urosome asymmetrical; luminous organ and fifth leg with shorter and broader end segment nearly always on left side__________ 2
   Urosome symmetrical; luminous organ and fifth leg with shorter and broader end segment nearly always on right side__________________ 3
2. Forehead with a pointed process; basal segment of first antenna without teeth on its anterior margin__________________ **xiphias** (p. 124)
   Forehead without a pointed process; basal segment of first antenna with small teeth on its anterior margin_____ **abdominalis** (p. 125)

3. Endopod of both second legs invaginated at its base inside, as in female; large, 3 mm. or more in length ________________ robusta (p. 126)
Endopod of right leg only invaginated, left second endopod like other legs; small, 2 mm. or less in length ________________ gracilis (p. 127)

PLEUROMAMMA XIPHIAS (Giesbrecht)

FIGURE 82

Pleuromma xiphias GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 347, pls. 32, 33, 1892.

Pleuromamma xiphias GIESBRECHT and SCHMEIL, Das Tierreich, Lief. 6, Copepoda, p. 110, 1898.

Occurrence.—One female from the trawl wings, Station 951, *Fish Hawk*, south of Marthas Vineyard; three females, trawl wings, Stations 2195, 2224, *Albatross*, south of Nantucket; two females, vertical haul, Station 20044, *Grampus*, south of Georges Bank.

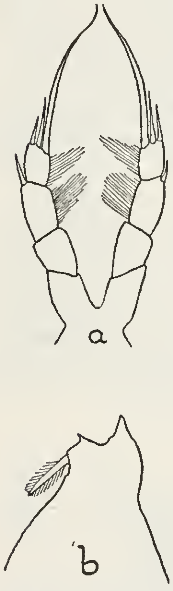

FIGURE 82.—*Pleuromamma xiphias: a,* Female, fifth legs; *b.* head, lateral view

Distribution.—Tropical Pacific (Giesbrecht); South African coast (Cleve, Stebbing); California coast (Esterly); Gibraltar (Thompson and Scott); Abrolhos Islands, Indian Ocean (Giesbrecht); Malay Archipelago (A. Scott); Gulf of Maine (Bigelow).

Color.—Body banded, translucent or nearly opaque bluish alternating with still more translucent or nearly transparent bands. Caudal segments, antennae, and all the appendages as clear and transparent as water. An elongate blotch of bright crimson extends lengthwise along the center of the ventral surface between and around the bases of the mouth parts and up into the head. The eye is small and a lighter red. (Rathbun.)

Female.—Body long and narrow; forehead just above the rostrum prolonged into a pointed process; head fused with the first segment; urosome less than half the length of the metasome; genital segment one-half longer than the two abdominal segments combined, protruding ventrally; luminous organ large, nearly always on the right side; fifth legs 4-segmented, the two distal segments fringed with long hairs on their inner margins, the end segment tipped with three setae, the inner one much longer than the other two. Total length, 4–4.5 mm.

Male.—Body more slender; urosome markedly asymmetrical, the second and third abdominal segments pushed to the right, the anal segment to the left; the left caudal ramus seems to come out of the side of the anal segment; the first, third, and fourth abdominal segments are heavily fringed with long hairs on the left side, the second segment on both sides; there is a stout fingerlike process on the right side of the anal segment near the center. Total length, 4–4.3 mm.

Remarks.—The sharp process on the forehead will distinguish this species. It is evidently a bottom form and has been obtained from various depths up to 1,500 meters or more.

PLEUROMAMMA ABDOMINALIS (Lubbock)

FIGURE 83

Diaptomus abdominale LUBBOCK, Trans. Ent. Soc. London, new ser., vol. 4, p. 28, pl. 10, figs. 1–8, 1856.

Pleuromamma abdominalis GIESBRECHT and SCHMEIL, Das Tierreich, Lief. 6, Copepoda, p. 109, 1898.

Occurrence.—Five females from trawl wings, Stations 2195, 2219, *Albatross*, south of Nantucket and Marthas Vineyard.

Distribution. — Northern Atlantic (Lubbock); Mediterranean (Claus, Giesbrecht); Hawaiian Islands (Brady); Canary Islands, Malta (Thompson); tropical Pacific (Giesbrecht); Malay Archipelago (A. Scott); Gulf of Maine (Bigelow).

Color.—Body fairly transparent and colorless, with red pigment flecks in varying numbers, especially in the region of the mouth. The skin glands are often greenish yellow and the region of the genital opening is dark brown or even black; eye ruby red. The luminous organ is very dark and in preserved specimens nearly always turns black.

Female.—Head fused with the first segment; basal segment of first antenna with several small and two large teeth on its anterior margin; urosome half as long as metasome; fifth legs 4-segmented; second and third segments each with an outer seta; third and fourth segments with an inner fringe of hairs; end segment obliquely truncated, with three apical setae, the inner one longer than the leg itself, the other two very much shorter. Total length, 2.4–3 mm.

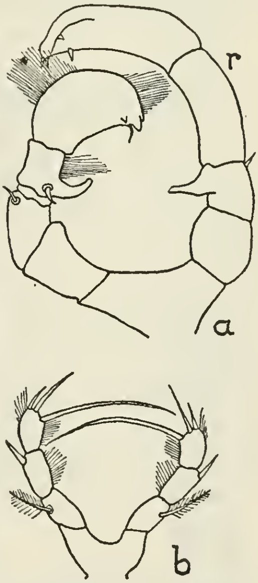

FIGURE 83.—*Pleuromamma abdominalis: a,* Male, fifth legs; *b,* female, fifth legs

Male.—Larger and a little stouter than the female basal segment of first antenna with small teeth only, no large ones; grasping antenna on right side; luminous organ and invaginated second endopod on left side; right second endopod not invaginated at the base; urosome asymmetrical, twisted to the left; fifth legs 5-segmented, fourth segment of left leg and third segment of right leg with a stout, pointed process on the inner margin; end segment of left leg short, wide, and laminate, with two dense tufts of long hairs on its outer margin. Total length, 3–3.35 mm.

Remarks.—The teeth on the anterior margin of the basal segment of the first antennae are the best single distinctive character. Esterly found this species common in both summer and winter on the California coast, but it seems to be only a straggler in the present area from the open ocean.

PLEUROMAMMA ROBUSTA (Dahl)

FIGURE 84

Pleuromma robustum Dahl, Zool. Anz., vol. 16, p. 105, 1893.
Pleuromamma robusta Sars, Crustacea of Norway, vol. 4, p. 115, pls. 78, 79, 1902.

Occurrence.—Two females in surface tow south of Gay Head, September, 1883; 25 males and females from trawl wings, Stations 2173, 2195, 2236, *Albatross*, south of Nantucket; 12 males and females in vertical haul, Station 10295, *Grampus*.

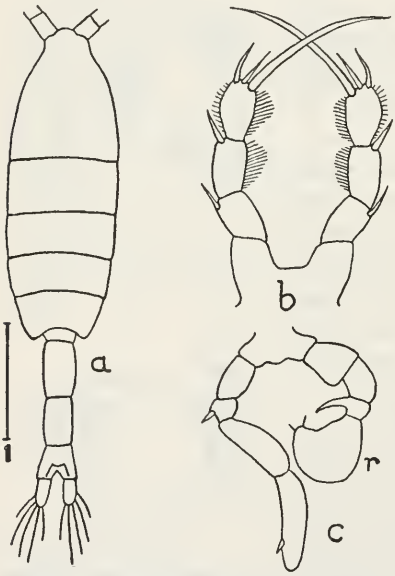

FIGURE 84.—*Pleuromamma robusta: a,* Female, dorsal (after Sars); *b,* female, fifth legs; *c.* male, fifth legs

Distribution.—Atlantic (Dahl); Norwegian coast (Sars); South African coasts (Cleve, Stebbing); Adriatic, Red Sea, Indian Ocean (Pesta); Faroe Channel, Irish coast (Norman); Gulf of Maine (Bigelow).

Color.—Body fairly transparent, with scattered flecks of red through the head and thorax, and an elongated spot on the ventral surface, embracing the mouth, the mouth parts, and the first two pairs of legs, which is dark red; eye spot a dark ruby red.

Female.—Body more robust than in the other species; metasome narrowed anteriorly; head separated from first segment; urosome half as long as metasome; genital segment no longer than the first abdominal segment and protruding ventrally; caudal rami shorter than the anal segment; fifth legs 4-segmented, the second and third segments with stout setae on the outer margin, the third and fourth segments fringed with long hairs on the inner margin, the end segment tipped with three setae, the inner one longer than the entire leg. Total length, 4–4.5 mm.

Male.—Smaller than the female; urosome symmetrical and very slender; left first antenna geniculate; endopod of both second legs invaginated; fifth legs very asymmetrical, 5-segmented, left leg longer and narrower than the right; end segment of the latter much widened, laminate and securiform; basal segments of first antennae armed with flattened, spatulate aesthetasks; luminous organ on the right side. Total length, 3–3.5 mm.

Remarks.—The large size, the symmetry of the urosome in both sexes, and the reversal of the fifth legs in the male are the chief characters of this species.

PLEUROMAMMA GRACILIS (Claus)

FIGURE 85

Pleuromma gracile CLAUS, Die frei lebenden Copepoden, p. 197, pl. 5, 1863.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 347, pls. 5, 32, 33, 1892.

Occurrence.—Two females in surface tow south of Gay Head, September, 1883; 1 female in surface tow on Georges Bank, September, 1872; 25 males and females from trawl wings, Station 2195, *Albatross.*

Distribution. — Nizza, Messina (Claus); North Atlantic (Cleve); tropical Atlantic (Giesbrecht); Indian Ocean (Giesbrecht); Gulf of Guinea (T. Scott); Mediterranean, Red Sea, Indian Ocean (Thompson and Scott); Adriatic (Steuer, Pesta); Malay Archipelago (A. Scott); California coast (Esterly); Gulf of Maine (Bigelow).

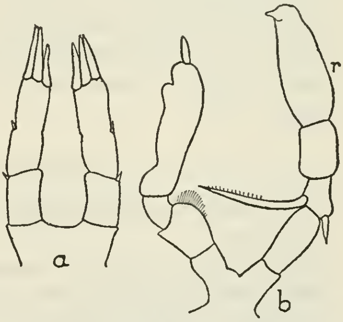

FIGURE 85.—*Pleuromamma gracilis:* *a,* Female, fifth legs; *b,* male, fifth legs

Color.—Body in general colorless and fairly transparent, with scattered red pigment; a narrow red line starts in the cephalon just above the mouth and runs backward along the median line to the first thoracic segment; another reddish line runs transversely along the anterior margin of the fourth segment, and there is a reddish spot above the rectum in the anal segment; the forehead, the skin glands, the area around the genital openings, and the dorsal surface of the caudal rami are greenish yellow; the luminous organ is dark reddish brown; the eye is dark ruby red (Rathbun).

Female.—Head separated from the first segment; urosome half as long as metasome; genital segment longer than both abdominal segments combined, swollen ventrally; fifth legs 4-segmented, the same diameter throughout and tipped with three stout spines, the inner of which is the shortest; the two distal segments of these fifth legs are often completely fused, except for the marginal sinuses, as shown in the figure, thus appearing 3-segmented. Total length, 1.5–2 mm.

Male.—Luminous organ and the widened and flattened fifth leg on the right side; endopod of right second leg invaginated, of left leg not invaginated; grasping antenna on the left side; basal segments of first antennae with small teeth only on the anterior margin, no large ones; spiniform process on third segment of right fifth leg denticulate distally; left leg apparently 4-segmented and about the same length as the right leg. Total length, 1.5–1.85 mm.

Remarks.—The symmetrical urosome, the form and armature of the fifth legs, and the fact that the second endopod on the left side in the male is not invaginated form the distinctive characters.

Family LUCICUTIIDAE

Genus LUCICUTIA Giesbrecht, 1898

Head separated from first segment; fourth and fifth segments fused with rounded corners; urosome 4-segmented in female, 5-segmented in male, symmetrical; exopod of second antenna 8-segmented; rami of first four pairs of legs 3-segmented; fifth legs biramose in both sexes, in the female exopods 3-segmented, endopods 2- or 3-segmented, in the male rami of right leg 2-segmented, of left leg 3-segmented.

KEY TO THE SPECIES (BOTH SEXES)

1. Total length more than 5 mm.; genital segment a little asymmetrical-- **grandis** (p. 128)
   Total length less than 3 mm.; genital segment symmetrical-- **curta** (p. 129)
   Total length between 3 mm. and 5 mm.; first antennae reaching at least 2 segments beyond caudal rami----------------- **magna** (p. 130)

LUCICUTIA GRANDIS (Giesbrecht)

FIGURE 86

Leuckartia grandis GIESBRECHT, Bull. Mus. Comp. Zool., vol. 25, no. 12, p. 258, pl. 4, fig. 4, 1895.

Lucicutia grandis VAN BREEMEN, Nordisches Plankton, Zoologischer Teil, vol. 4, Entomostraca, Copepoda, p. 114, fig. 131, *a–c*, 1908.

Occurrence.—One female from trawl wings, Station 1029, *Fish Hawk*, southeast of Nantucket; five males and females from trawl wings, Stations 2195, 2219, 2224, *Albatross*, south of Marthas Vineyard; two males in vertical haul, Station 20069, *Grampus.*

Distribution.—Atlantic, north of British Isles (Wolfenden); Pacific, off Ecuador (Giesbrecht); Gulf of Maine (Bigelow).

Color.—Body transparent and colorless, except that some of the setae and spines on the mouth parts and the swimming legs are dark reddish brown; eye red.

Female.—First antennae reaching at least four segments beyond the caudal rami, the basal segments considerably enlarged; urosome two-fifths as long as metasome; genital segment protruding a little on the left side and ventrally, making it slightly asymmetrical; caudal rami six times as long as wide, outer seta one-third the length of the ramus from its tip; fifth legs reduced in size, endopod not reaching beyond the second segment of the exopod. Total length, 6–6.5 mm.

Male.—Body shorter and more slender than that of the female, first antennae as long, the grasping antenna on the left side; second basipods of fifth legs protruding inwardly against each other; end segment of right exopod turned back against the basal segment, end segment of right endopod armed with six stout plumose setae; left endopod reaching beyond the tip of the second exopod segment; end segment of left exopod scarcely longer than the second segment. Total length, 5.5–6 mm.

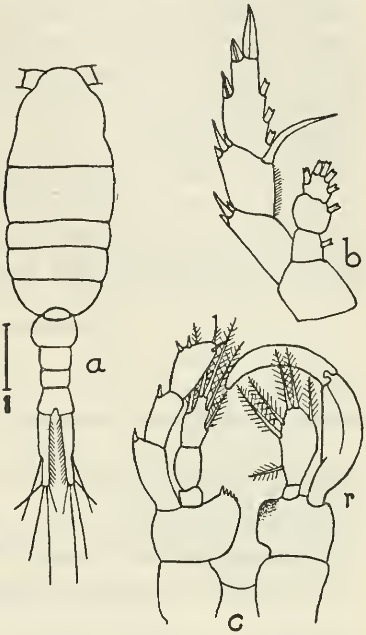

FIGURE 86.—*Lucicutia grandis: a,* Female, dorsal; *b,* female, fifth leg; *c,* male, fifth legs, right exopod straightened

Remarks.—The large size of this species and the length of the first antennae are distinctive characters, which can then be supplemented by the form of the fifth legs. Evidently the species is nowhere very abundant.

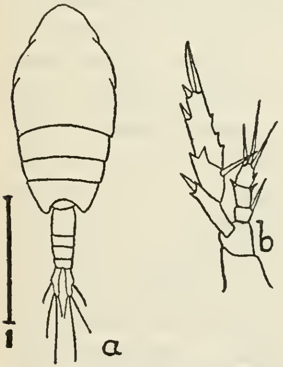

FIGURE 87.—*Lucicutia curta: a,* Female, dorsal (after Farran); *b,* female, fifth leg

LUCICUTIA CURTA Farran

FIGURE 87

Lucicutia curta FARRAN, Rep. Fisheries Ireland, 1902–1903, pt. 2, p. 44, pl. 12, figs. 1–7, 1905.—VAN BREEMEN, Nordisches Plankton, Zoologischer Teil, vol. 4, Entomostraca, Copepoden, p. 115, fig. 132, 1908.

Occurrence.—One female from the trawl wings, Station 2195, *Albatross*, south of Marthas Vineyard.

Distribution.—North Atlantic (Farran, van Breemen); Gulf of Maine (Bigelow).

Color.—No statement has ever been made with reference to the color.

Female.—First antennae reaching the caudal rami; urosome less than half the length of the metasome, symmetrical; genital segment as long as the first two abdominal segments combined; caudal rami four times as long as wide; outer seta in the center of the outer margin; spine on inner margin of second segment of fifth exopod straight and scarcely more than half the length of the end segment; the latter as long as the two basal segments combined. Total length, 2–2.4 mm.

Male.—Unknown.

Remarks.—This species may be distinguished by its small size, by the proportions of the various parts of the body, and by the fifth legs. Thus far it has been reported only from the northern Atlantic on both the European and American sides.

LUCICUTIA MAGNA Wolfenden

Figure 88

Lucicutia magna, male, Wolfenden, Journ. Marine Biol. Assoc., new ser., vol. 7, p. 121, pl. 9, figs. 35, 35*a*, 1904.

Lucicutia atlantica, female, Wolfenden, Journ. Marine Biol. Assoc., new ser., vol. 7, p. 121, 1904.

Lucicutia magna, male and female, Wolfenden, Deutsche Südpolar Expedition, Copepoden, vol. 12, pt. 4, p. 316, fig. 59, 1911.

Occurrence.—One male from the trawl wings, Station 2195, *Albatross*, south of Nantucket Island.

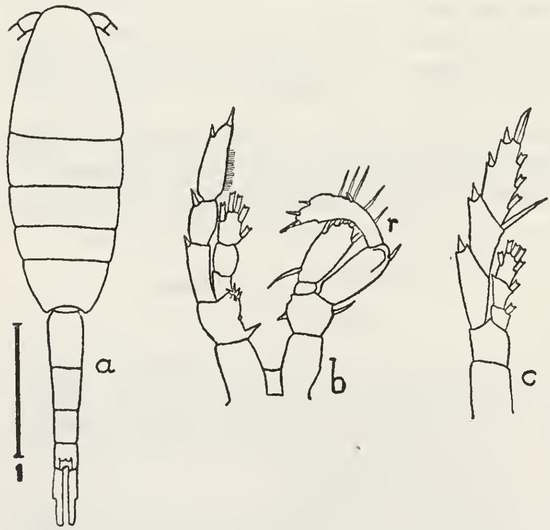

Figure 88.—*Lucicutia magna; a*, Female, dorsal (after Sars); *b*, male, fifth legs; *c*, female, fifth leg

Distribution.—North Atlantic (Wolfenden, Farran, van Breemen); Antarctic Ocean (Wolfenden).

Color.—Unknown.

Female. — Metasome one-half longer than urosome; genital segment as long as the first two abdominal segments combined; first antennae reaching two segments beyond the tips of the caudal rami; the latter five times as long as wide; endopod of first leg 2-segmented; terminal spine of second exopod one-third as long as the end segment; endopod of fifth leg scarcely reaching the middle of the second exopod segment; inner spine of second exopod segment as long as the segment itself and denticulate near its tip. Total length, 3.5 mm.

Male.—First antennae as long as in the female and endopod of first leg 2-segmented; right fifth leg with a stout spine on the inner margin of the second basipod; end segment of exopod turned inward at right angles to the basal segment, and curved over the tip of the endopod; second basipod of left leg with a stout spine on the proximal inner corner, and a bunch of small spines at the distal inner corner; left fifth endopod not reaching the distal end of the second exopod segment. Total length, 3.54 mm.

Remarks.—Wolfenden first described the two sexes as separate species, but in 1911 recognized them as male and female of the same species. The 2-segmented endopod of the first leg and the spines of the inner margin of the second basipods of the fifth legs in the male are the chief characteristics. The species has never before been reported from our American shores, and would seem to be a bottom form, being found by Wolfenden at depths of 1,500 to 3,000 meters.

Two males of *Lucicutia grandis* were obtained by the *Grampus* just outside the present area southeast of Georges Bank, and the species is likely to be obtained within the area at some future time.

Family HETERORHABDIDAE

Genus HETERORHABDUS Giesbrecht, 1898

Head separated from the first segment, with a distinct cervical depression on the dorsal surface; urosome 4-segmented in female, 5-segmented in male; genital segment nearly as long as the abdomen and protruding ventrally; caudal rami asymmetrical, the left one the larger, its second inner terminal seta greatly elongated; eye not visible; rami of all five pairs of legs 3-segmented; exopods of second, third, and fourth legs considerably enlarged, especially the end segment; fifth exopod in female with a slender falciform spine inside the second segment; fifth exopods in male more or less prehensile, without plumose setae.

KEY TO THE SPECIES (BOTH SEXES)

1. First antennae not reaching caudal rami; frontal projection a rounded knob; fifth exopod in female twice as long as endopod. **norvegicus** (p. 132)

   First antennae reaching from 4 to 8 segments beyond tips of caudal rami ---------- 2

2. Frontal projection a sharp spine; end segment of third exopod unlike those of second and fourth legs, widened into an oval lamina ---------- **spinifrons** (p. 133)

   Frontal projection a flattened knob, nearly obsolete; end segment of third exopod like those of second and fourth legs -- **longicornis** (p. 134)

HETERORHABDUS NORVEGICUS (Boeck)

FIGURE 89

Heterochaeta norvegica BOECK, Forh. Vid.-Selsk. Christiania, 1872, p. 40.
Heterorhabdus norvegicus SARS, Crustacea of Norway, vol. 4, p. 118, pls. 80, 81, 1902.

Occurrence.—Five males and females in a vertical haul, Station 10295, *Grampus*, off Georges Bank; six males and females, vertical haul, Station 20044, *Grampus*.

Distribution.—Norwegian coast (Boeck, Sars); Polar Basin (Sars); Greenland, Faroe Channel (Norman); Arctic Ocean (Mrázek, Damas and Koefoed, Vanhöffen); Gulf of Maine (Bigelow).

Color.—Body highly transparent and colorless, with a faint tinge of yellow; the metasome contains scattered oil globules, which are highly refractive; the muscles become pink in formalin.

Female.—Metasome nearly three times as long as wide, narrowed anteriorly; frontal projection knoblike; head with a dorsal cervical depression; urosome, including caudal rami, half as long as metasome; genital segment swollen anteriorly and ventrally; left caudal ramus larger than right, second inner seta twice the length of the metasome; exopod of fifth legs twice as long as the endopod, falciform spine on inner margin of its second segment turned squarely inward and as long as end segment, apical spine half as long. Total length, 3.8–4.2 mm.

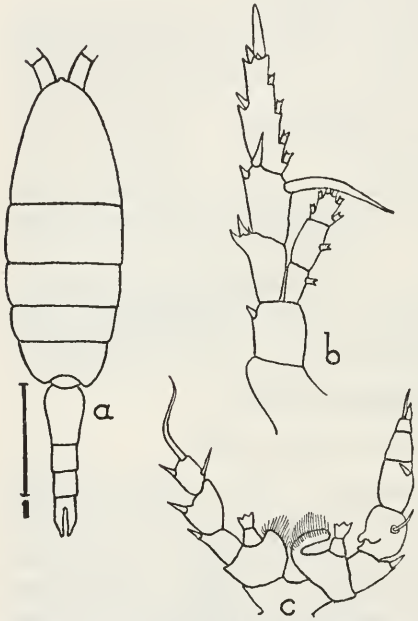

FIGURE 89.—*Heterorhabdus norvegicus*: *a*, Female, dorsal (after Sars); *b*, female, fifth leg; *c*, male, fifth legs

Male.—Body more slender than in the female, urosome longer and narrower; left first antenna geniculate, not much swollen, its terminal portion 4-segmented; the inner sausage-shaped process on the second basipod of the right fifth leg is abruptly curved and fringed with coarse hairs; the first exopod segment is produced at the outer corner, the second segment is oval in form, with an irregular protuberance on the inside; the left exopod is about the same length as the right, the end segment is lamellar and is tipped with a short outer spine and a slender flexuous inner one. Total length, 3.75–4.2 mm.

Remarks.—This species may be recognized by its large size, by the relative shortness of the first antennae, and by the fifth legs, especially of the male. From the distribution here given it is shown to be a northern form, and is more or less of a straggler in the present area.

HETERORHABDUS SPINIFRONS (Claus)

Figure 90

Heterochaeta spinifrons Claus, Die frei lebenden Copepoden, p. 182, pl. 32, 1863.
Heterorhabdus spinifrons Giesbrecht and Schmeil, Das Tierreich, Lief. 6, Copepoda, p. 114, 1898.

Occurrence.—Twenty males and females taken in a vertical haul, Station 20107, *Grampus*, off Georges Bank.

Distribution.—Messina (Claus); north of British Isles (Möbius); tropical Pacific (Giesbrecht); Malta (Thompson); Mediterranean (Giesbrecht); Gulf of Guinea (T. Scott); Malay Archipelago (A. Scott); northern Atlantic (Cleve); California coast (Esterly); Adriatic (Pesta); Indian Ocean (Thompson and Scott); Gulf of Maine (Bigelow):

Color.—Body transparent and colorless; ovaries, oviducts, and eggs yellowish green; ventral portion of genital segment light brown, often with a yellowish tinge; no eye visible.

Female.—Frontal process transformed into a sharp spine; first antennae reaching 4 or 5 segments beyond the caudal rami; end segment of third exopod a broadened oval, wider and longer than in the second and fourth legs; endopod of fifth leg longer than the two basal segments of the exopod; falciform spine on inner margin of second exopod segment not so long as the end segment; terminal spine denticulate on the outer margin and half as long as end segment. Total length, 3–3.5 mm.

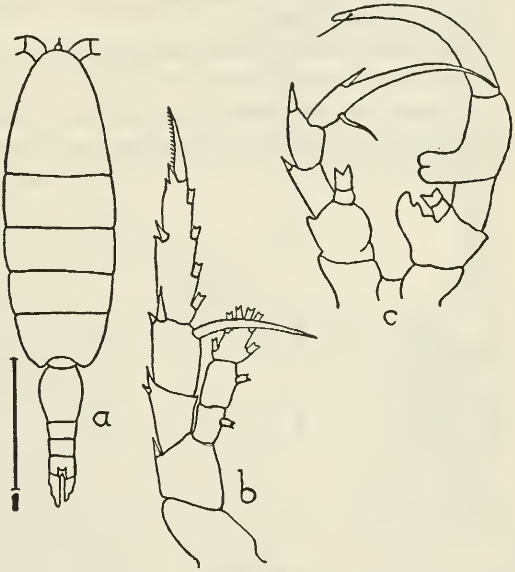

Figure 90.—*Heterorhabdus spinifrons: a,* Female, dorsal (after Sars); *b,* female, fifth leg; *c,* male, fifth legs

Male.—Smaller and more slender than the female; in the right fifth leg the second basipod and the second exopod segments have each an inner process, the latter bipartite at the tip; end segment one-half longer than the two basal segments, slender, tapered conically, and curved inward; in the left leg the second basipod and the first two exopod segments are each produced at the outer distal corner, the process on the second exopod segment much the largest and tipped with a stout spine; end segment twice as long as the two basal segments combined and acuminate, with a single spine on each lateral margin. Total length, 2.95–3.3 mm.

Remarks.—The most conspicuous character of this species is the spine on the forehead, from which its name is derived. It is manifestly " an accidental visitor from warmer and more oceanic waters offshore," as Bigelow has characterized it.

HETERORHABDUS LONGICORNIS (Giesbrecht)

FIGURE 91

Heterochaeta longicornis GIESBRECHT, Atti Accad. Lincei, Rome, ser. 4, vol. 5, sem. 1, p. 812, 1889.

Heterorhabdus longicornis GIESBRECHT and SCHMEIL, Das Tierreich, Lief. 6, Copepoda, p. 116, 1898.

Occurrence.—One male and three females from trawl wings, Stations 2093, 2195, 2236, *Albatross*, south of Nantucket and Marthas Vineyard; two males and one female in a vertical haul, Station 20107, *Grampus*, off Georges Bank.

Distribution.—Tropical Atlantic (Giesbrecht); California coast (Esterly); North Atlantic, Faroe Channel (Wolfenden); Malay Archipelago (A. Scott); Irish Sea (Pearson, Farran); Gulf of Maine (Bigelow).

Color.—Body transparent and colorless, except for an irregular yellow spot in the center of the metasome; eye not visible (Rathbun).

Female.—First antennae reaching six to eight segments beyond the caudal rami; metasome two and one-half times as long as wide, much narrowed anteriorly; urosome half as long as metasome; genital segment as long as the first two abdominal segments combined; second inner terminal seta of left caudal ramus jointed near its base and longer than the entire body; second exopod segment of fifth leg with a compound 7-pointed spine on the anterior surface near the distal margin; apical exopod spine nearly as long as end segment. Total length, 2.5–3 mm.

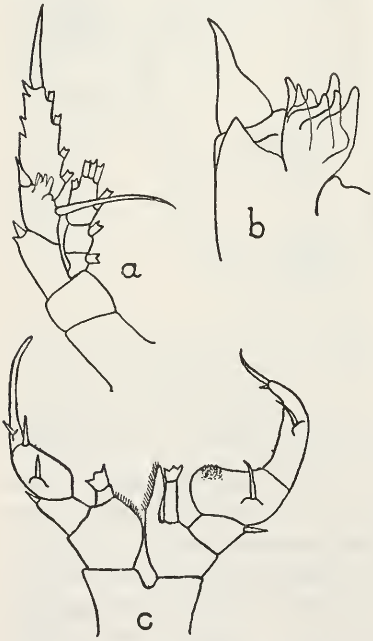

FIGURE 91.—*Heterorhabdus longicornis: a*, Female, fifth leg; *b*, spines on second segment of fifth exopod; *c*, male, fifth legs

Male.—As large as female or larger; urosome relatively longer and symmetrical; second inner caudal seta of left ramus as in female; second basipod of right fifth leg with a straight fingerlike process, covered with stiff hairs, at its inner distal corner; second segment of exopod swollen into a globular protuberance covered with minute spines; second basipod of left fifth leg with a convex inner margin fringed with short hairs. Total length, 3–3.25 mm.

Remarks.—The exceptional length of the first antennae and the elongated caudal seta are the distinguishing characters. This is apparently a deep-water form and does not come into shallow water or near the surface.

Genus AUGAPTILUS Giesbrecht, 1889

Head separated from the first segment; fourth and fifth segments fused with rounded corners; urosome 3-segmented in female, 5-segmented in male; genital segment usually somewhat asymmetrical in female; rami of all five pairs of legs 3-segmented, the fifth pair natatory like the others; grasping antenna of the male sometimes on the right, sometimes on the left side. One species found here.

AUGAPTILUS FILIGERUS (Claus)

FIGURE 92

Hemicalanus filigerus CLAUS, Die frei lebenden Copepoden, p. 179, 1863.

Augaptilus filigerus GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 400, pls. 3, 27, 28, 29, 39, 1892.

Occurrence.—Two males and one female from trawl wings, Stations 2219, 2230, *Albatross*, south of Long Island.

Distribution.—Mediterranean (Giesbrecht, Pesta); North Atlantic (van Breeman); Messina (Claus); Adriatic (Pesta); South Atlantic (Wolfenden); Malay Archipelago (A. Scott).

Color.—Body transparent, the second and third thoracic segments with a wash of green, the plumose setae on the antennae, the mouth parts, and the caudal rami much elongated, especially in the male, and tinged with reddish brown distally, the color becoming pronounced at the tips. A pair of small red globules in the second segment of the thorax; no eye visible.

Female.—Genital segment protruding ventrally and twisted to the left asymmetrically; caudal rami slightly longer than wide; first antennae reaching six to eight segments beyond the caudal rami; exopod of second antenna less than half as long as endopod; outer seta on second basipod of fifth legs twice as long as the whole exopod; inner apical seta of latter considerably longer than the end segment. Total length, 4.5–4.9 mm.

Male.—Genital segment symmetrical, but with the sexual opening on the right side; grasping antenna on the left side; second basipod of right fifth leg with an inner truncated process tipped with stiff hairs; second segment of right exopod with an irregular inner process; outer lateral spine of end segment turned squarely inward. Total length, 4–4.5 mm.

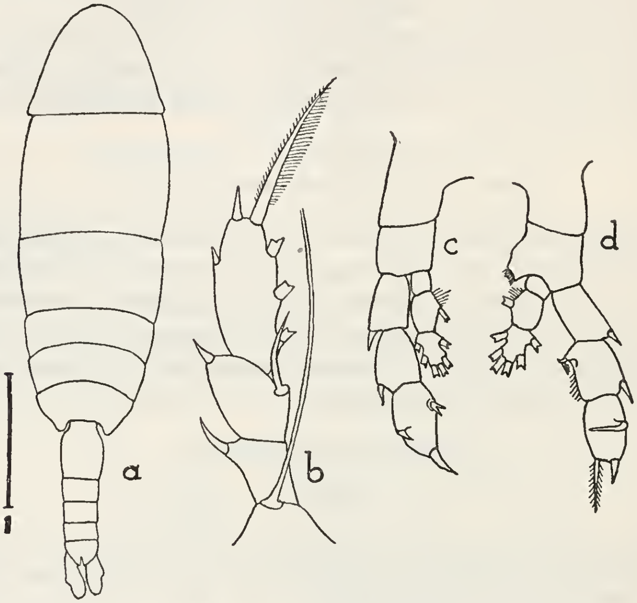

FIGURE 92.—*Augaptilus filigerus: a,* Male, dorsal; *b,* female, fifth leg; *c, d,* male, fifth legs

Remarks.—This species has not been reported before from the American side of the Atlantic. It may be recognized by the exceptionally long first antennae and the details of the fifth legs. Apparently it is nowhere found in any abundance and hence is not of economic importance although it is of fairly large size.

Family ARIETELLIDAE

Genus PHYLLOPUS Brady, 1883

Head separated from the first segment; fourth and fifth segments fused and produced asymmetrically at the posterior corners; urosome 4-segmented in female, 5-segmented in male; first antennae not reaching the genital segment; exopod of second antenna twice as long as endopod; first four pairs of legs with 3-segmented rami; fifth legs uniramose in female and 5-segmented, left leg in male with a rudimentary endopod, right leg uniramose, exopods 3-segmented. One species found here.

PHYLLOPUS BIDENTATUS Brady

Figure 93

Phyllopus bidentatus Brady, Voyage of H. M. S. *Challenger*, vol. 8, pt. 23, Copepoda, p. 78, pl. 5, figs. 7–16, 1883.—A. Scott, *Siboga*-Expeditie, 29a, Copepoda, pt. 1, p. 147, pl. 45, figs. 1–9, 1909.

Occurrence.—One female taken in a vertical haul, Station 20107, *Grampus*, off Georges Bank.

Distribution.—South Atlantic, off Buenos Aires (Brady); Galapagos Islands (Giesbrecht); northern Atlantic (Wolfenden); California coast (Esterly); Gulf of Guinea (T. Scott); Malaysia (A. Scott); South African coast (Cleve, Stebbing).

Color.—Body transparent and colorless.

Female.—Metasome twice as long as wide, its posterior corners produced into sharp processes, the right one larger than the left; fifth legs 5-segmented, the second (basipod) segment with a long plumose seta at the outer distal corner, the fourth segment with a similar seta at the inner distal corner; end segment shortened and tipped with an inner spine and a toothed lobe. Total length, 2–2.8 mm.

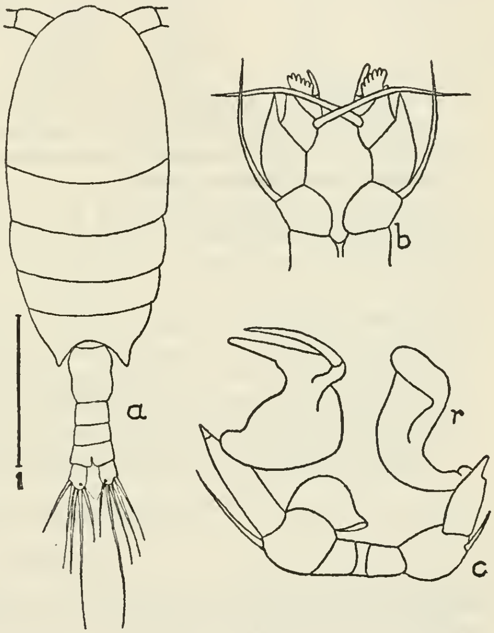

Figure 93.—*Phyllopus bidentatus: a*, Female, dorsal; *b*, female, fifth legs; *c*, male, fifth legs (after A. Scott)

Male.—Left antenna geniculate; urosome symmetrical; fifth legs each with two basipod and two exopod segments, left leg with a 1-segmented, lamellar endopod, without setae or spines, right leg without an endopod; first exopod segment of both legs produced at the outer distal corner and armed with a short spine; the two distal exopod segments of each fifth leg rather bizarre in shape and arrangement. Total length, 2–2.25 mm.

Remarks.—The fifth legs furnish the distinctive characters of this species; it is a rare form, and most of the authors mentioned above report but a single specimen each.

Family CANDACIIDAE

Genus CANDACIA Dana, 1846

Head separated from first segment and rectangular in shape; fourth and fifth segments fused and produced asymmetrically at the posterior corners; urosome 3-segmented in female, 5-segmented in male, often asymmetrical; endopods of first four pairs of legs, 2-segmented, exopods 3-segmented, their outer margins toothed; fifth legs uniramose, rudimentary, armed only with spines, or naked setae.

KEY TO THE SPECIES

FEMALES

1. End segments of fifth legs with 2 large apical spines, 3 smaller spines on outer, 3 setae on inner, margin ______________ **norvegica** (p. 138)
   End segment of fifth legs with 1 apical spine, 3 spinules on outer margin, inner margin naked ____________________________ **armata** (p. 139)
   End segment of fifth legs with 3 stout apical spines, 1 outer spine and 3 inner setae __________________________ **pachydactyla** (p. 141)

MALES

1. Projection on right side of genital segment large and irregularly tubercular at tip ______________________________________ **norvegica** (p. 138)
   Projection on right side of genital segment small and acuminate; both corners of fifth segment reaching abdomen _________ **armata** (p. 139)
   Projection on right side of genital segment fingerlike and blunt; right corner only of fifth segment reaching abdomen _ **pachydactyla** (p. 141)

CANDACIA NORVEGICA (Boeck)

FIGURE 94

Candace norvegica BOECK, Forh. Vid.-Selsk. Christiania, 1864, p. 235.
Candacia norvegica SARS, Crustacea of Norway, vol. 4, p. 134, pls. 89, 90, 1902.

Occurrence.—Two males and 1 female in a vertical haul, Station 20129, *Grampus*, southeast of Nantucket.

Distribution.—Norwegian coast (Boeck, Sars); Gulf of Maine (Bigelow).

Color.—Body highly transparent and practically colorless.

Female.—Metasome three times as long as wide; posterior corners of fifth segment pointing outward and acute; urosome perfectly symmetrical and one-third as long as metasome; genital segment armed on either lateral margin with a small spine, pointing diagonally backward; end segment of fifth legs much longer than the two basal segments combined, tipped with two stout, unequal spines, three shorter spines on the outside, three spinelike setae inside. Total length, 3–3.35 mm.

Male.—Right corner of fifth segment dark colored, highly chitinized, and curved inward, left corner as in female; genital segment with a stout projection on the right side; its tip made up of irregular tubercles, giving it a broken appearance; fifth legs uniramose, left leg 4-segmented, right leg 3-segmented, the two distal segments forming a pair of curved and bluntly pointed scissors, used in handling the spermatophores. Total length, 2.9–3.2 mm.

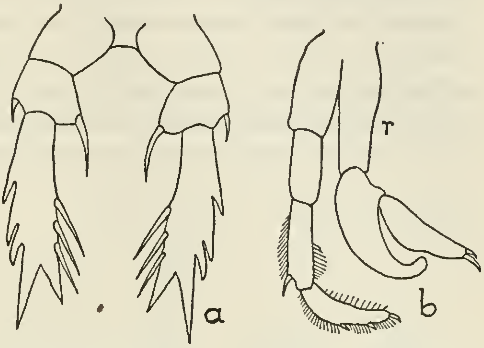

Figure 94.—*Candacia norvegica: a,* Female, fifth legs; *b,* male, fifth legs

Remarks.—This is the only record of the species outside of Norway; it can be recognized most easily by the structure of the fifth legs, especially in the female. Boeck's brief and imperfect description left the species somewhat questionable, but Sars fully established its validity.

CANDACIA ARMATA (Boeck)

Figure 95

Candace armata Boeck, Forh. Vid.-Selsk. Christiania, 1872, p. 39.
Candacia armata Sars, Crustacea of Norway, vol. 4, p. 135, pl. 91, 1902.

Occurrence.—Five females in surface tow on Georges Bank, September, 1872; 8 males and females from trawl wings, Stations 2195, 2235, 2236, *Albatross*, south of Nantucket and Marthas Vineyard; 27 males and females in vertical hauls, Stations 20053, 20129, *Grampus*, on Georges Bank.

Distribution.—Norwegian coast (Boeck, Sars); British Isles (Brady); northern Atlantic (Cleve); Mediterranean (Giesbrecht); Gulf of Maine (Bigelow); Gulf Stream south of Marthas Vineyard (Wheeler); Chesapeake Bay (Wilson).

Color.—Body moderately transparent and whitish; head with a reddish tinge; the chitin of the posterior margins of the thoracic segments, the pointed corners of the fifth segment, the genital orifice, the setae of the exopods, and sometimes the endopods, of the swimming legs, and the eighteenth and nineteenth segments of the first antennae are blackish brown of varying intensity.

Female.—Metasome little more than twice as long as wide; fifth segment produced into broad spines which just reach the abdomen; urosome asymmetrical, the genital segment inflated on the right side, the first abdominal segment with a ventral protuberance turned to the right, the anal segment with an irregular dorsal projection turned to the left; left caudal ramus the smaller; end segment of fifth legs tapered to a single acute point, inner margin smooth, outer with 3 minute spinules. Total length, 2.5–2.75 mm.

Male.—A little smaller than the female and more slender; the right spine at the corner of the fifth segment larger than the left, curved inward and reaching the posterior margin of the genital segment; genital segment with a short acuminate process on the right side at the posterior end; the second segment of the right fifth leg is stouter and its inner process shorter, and the end segment is also shorter than in *norvegica*, forming what Sars termed "a somewhat irregular chela" rather than scissor blades. Total length, 2.25–2.6 mm.

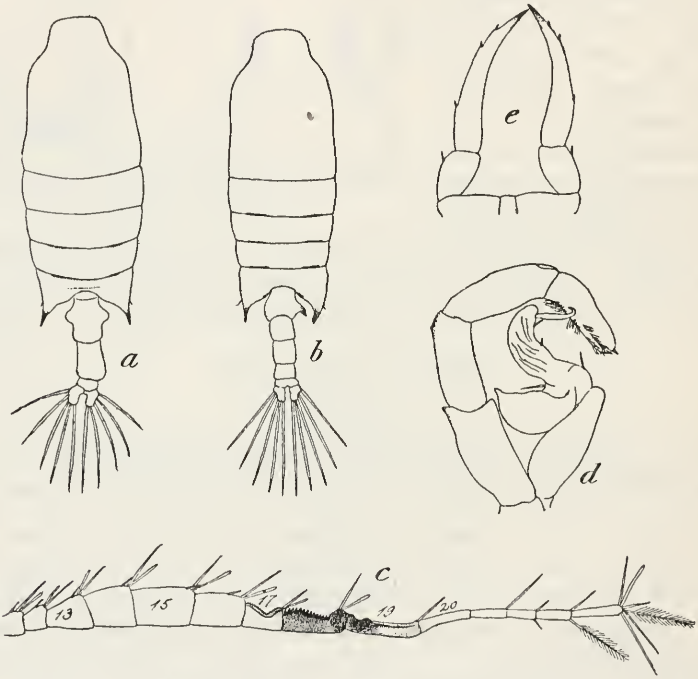

FIGURE 95.—*Candacia armata: a,* Female, dorsal; *b,* male, dorsal; *c,* male, right first antenna; *d,* male, fifth legs; *e,* female, fifth legs. (From W. M. Wheeler)

Remarks.—This is another of Boeck's questionable species that was fully established by Sars. It is more widely distributed than *norvegica* and is the form found in considerable numbers by Wheeler in the Gulf Stream south of Marthas Vineyard and identified by him as *Candacia pectinata* Brady, which is a synonym of the present species. The fifth legs in both sexes furnish a ready means of identification.

CANDACIA PACHYDACTYLA (Dana)

FIGURE 96

Candace pachydactyla DANA, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 23, 1849.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 424, pls. 21, 22, 39, 1892.

Occurrence.—A male and a female taken in a surface tow southeast of Nantucket August, 1886; 5 males and females from trawl wings, Stations 2194, 2195, *Albatross*, south of Nantucket.

Distribution.—China Sea, tropical Atlantic (Dana); Fiji Islands, Philippines (Brady); Malta (Thompson); tropical Atlantic (Krøyer, Giesbrecht, Cleve); Gulf of Guinea (T. Scott); South African coast (Cleve, Stebbing); Indian Ocean, Ceylon (Thompson and Scott); northern Atlantic (Wolfenden); Bay of Bengal (Sewell); eastern Atlantic (Lubbock); Malay Archipelago (A. Scott).

Color.—Body moderately transparent and colorless except for scattered red oil drops and the reddish or yellowish oviducts. The chitin of the body and the appendages, especially the end segments of the second, third, and fourth exopods, and the stout spines on the fifth legs of the female, have a reddish-brown wash of greater or less intensity; no eye is visible.

Female.—Metasome two and one-half times as long as wide, spines at the posterior corners short, not reaching the center of the genital segments; urosome stout, one-third as long as metasome; genital segment longer than abdomen, with a ventrolateral process on either side behind the genital opening; terminal segment of fifth legs much longer than the two basal segments combined, with three short and stout apical spines, a coarse spine at the center of the outer margin, and three setalike spines close together and nearer the distal end of the inner margin. Total length, 2.4–3 mm.

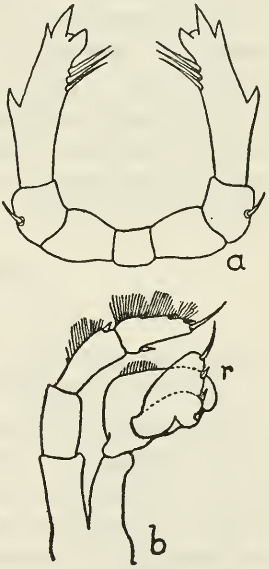

FIGURE 96.—*Candacia pachydactyla: a*, Female, fifth legs; *b*, male, fifth legs

Male.—The right spine at the corner of the fifth segment much longer than the left, reaching the center of the first abdominal segment, and curved inward at its tip, which is boot-shaped, with a heel; genital segment with a bluntly rounded process on the right side near the posterior end; inner process of second segment of right fifth leg turned outward alongside the end segment and curved at the tip; end segment lobed, with a short spine on each lobe and a longer one at the apex. Total length, 2.3–2.6 mm.

Remarks.—This species has never before been reported from our American shores. The fingerlike processes on the genital segment, two in the female and one in the male, and the form of the fifth legs in both sexes, furnished the best means of identification.

Family PONTELLIDAE

Genus ANOMALOCERA Templeton, 1837

Head with distinct lateral hooks and 2 pairs of dorsal cuticular lenses; fourth and fifth segments separated, the corners of the latter forming triangular spines, symmetrical in the female, conspicuously asymmetrical in the male; urosome 3-segmented in female, 5-segmented in male; ventral eye enormously developed in the male and club-shaped; right antenna of male geniculate and much swollen; first legs with 3-segmented rami, exopods of second, third, and fourth legs 3-segmented, endopods 2-segmented; fifth legs biramose in female, rami more or less unequal; uniramose in male, the right leg with a weak chela. One species found here.

ANOMALOCERA PATERSONII Templeton

FIGURE 97

Anomalocera patersonii TEMPLETON, Trans. Ent. Soc. London, vol. 2, p. 35, pl. 5, 1837.—SARS, Crustacea of Norway, vol. 4, p. 139, pls. 92–94, 1902.

Occurrence.—Six males and females in surface tow on Georges Bank, September, 1872; 15 males and females taken by Rathbun in surface tow south of Gay Head, September, 1883; 20 males and females in trawl wings, Stations 949, 993, 1032, *Fish Hawk*, south of Nantucket; 2 females in surface tow, east of Cape Cod, July, 1890; hundreds of specimens from all over the Gulf of Maine, especially along the northern side of Georges Bank, within the limits of the present area.

Distribution.—British Isles (Brady, T. Scott); coast of France (Canu); Mediterranean (Claus, Giesbrecht); North Atlantic (Giesbrecht); Black Sea (Karawajew); Gulf of St. Lawrence (Herdman); Skager Rak (Cleve); Arctic Ocean (Mrázek); North Sea (van Breemen); Indian Ocean, Pacific (Giesbrecht and Schmeil); off Nova Scotia (Willey); Adriatic (Pesta); Woods Hole (Wheeler, Fish); Chesapeake Bay (Wilson); Norwegian coast (Sars).

Color.—The colors are nearly as varied as in Brady's figure,[5] but not entirely the same. The first antennae and appendages have a prevailing blue color, but are quite translucent or even transparent.

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[5] British Copepoda, vol. 1, pl. 11, fig. 1, 1878.

The color is not intense except at the overlapping joints and where one appendage lies above another. Living specimens have a whitish color, the third segment being deeply mottled and standing out plainly in contrast with the rest of the body. The dorsal half of this segment is light green and yellow, the former in irregular spots, the latter in uneven blotches, denser in some places than in others. The lower half of the segment has blue in place of green, similarly distributed over yellow. The posterior margin of the segment has an irregular border of dense indigo, and there was a similar border on the second segment. The two colors, blue and green, are almost always present in varying proportions and silver and black mark the back to a greater or less extent. Sometimes two, sometimes three or more, of the segments are pure silvery on the dorsal surface, with a good-sized black spot in the center of the silver. Or the silver may be marked with irregular black lines or divided by a streak of green. Sometimes there are two rows of numerous black spots extending along either side of the dorsal surface, with or without the silver. The eye spots are a deep black. (Rathbun.)

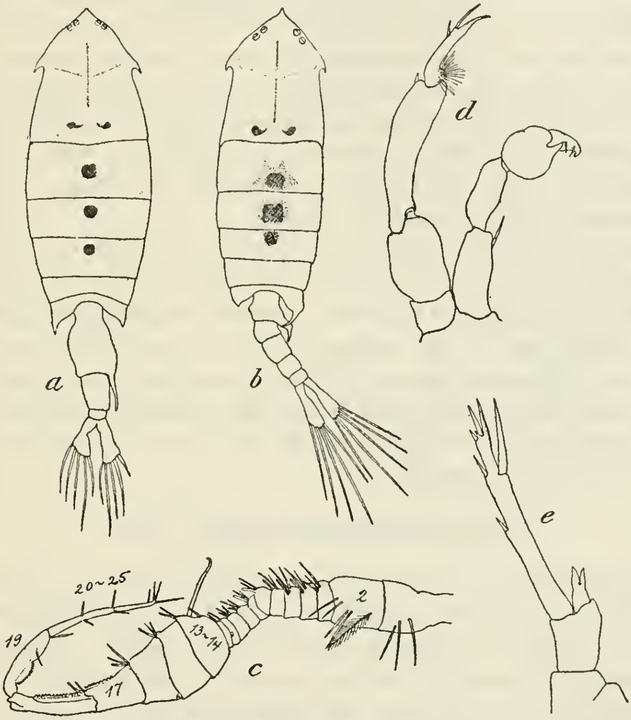

FIGURE 97.—*Anomalocera patersonii: a,* Female, dorsal; *b,* male, dorsal; *c,* male, right first antenna; *d,* male, fifth legs; *e,* female, fifth legs (usually with a 2-segmented exopod). (From W. M. Wheeler)

Female.—Metasome three times as long as wide, head triangularly pointed, the lateral angles forming hooks; corners of fifth segment broadly triangular, reaching the center of the genital segment; urosome asymmetrical, the genital segment produced ventrally on the right side, and the right caudal ramus larger than the left and turned outward; each fifth leg with two basipod segments, a very short 1-segmented endopod, and a 2-segmented exopod eight or nine times as long. Total length, 3–3.25 mm.

Male.—Posterior corners of fifth segment very asymmetrical, the right lobe produced into a fingerlike process that curves inward and almost touches the first abdominal segment; genital segment with a triangular projection on the right side at the posterior corner; abdomen and caudal rami symmetrical; left fifth leg with a small end segment tipped with a short claw, right leg with a terminal quadrangular chela, the thumb very small, the finger curved and spoon-shaped. Total length, 2.5–3 mm.

Remarks.—This species is known to Norwegian fishermen as "bluebait," and its presence in the fiords indicates the approach of herring. As noted by Sars it has the habit of swimming near the surface and often jumping out of the water. Wheeler and Fish agree that it appears in the present area only after prevailing south winds. The modified antenna of the male is carried pointing straight in front of the body, and this with its indigo-blue color enables one to distinguish the species readily.

Genus LABIDOCERA Lubbock, 1853

Head separated from first segment, with or without lateral hooks, and with one pair of dorsal cuticular lenses; fourth and fifth segments fused, the corners produced into pointed lobes; urosome 2- or 3-segmented in female, 4- or 5-segmented in male; genital segment and sometimes the caudal rami asymmetrical in the female, but symmetrical in the male; first four pairs of legs with 3-segmented exopods and 2-segmented endopods; fifth legs biramose in female, right leg of male uniramose with a chela, left leg often with a rudimentary endopod.

KEY TO THE SPECIES

FEMALES

1. Head with a distinct median crest; corners of fifth segment symmetrical, but urosome very asymmetrical ------------ **acutifrons** (p. 145)
   Head without a median crest; urosome symmetrical ------------------------ 2
2. Corners of fifth segment angular but not produced; endopods of fifth legs mere knobs, less than one-fourth as long as exopods -- **nerii** (p. 146)
   Corners of fifth segment produced into acuminate lobes; endopods of fifth legs more than one-half as long as exopods -- **aestiva** (p. 147)

MALES

1. Head with a distinct median crest; urosome and corners of fifth segment slightly asymmetrical______________________ acutifrons (p. 145)
   Head without crest; urosome and corners of fifth segment symmetrical____ 2
2. Right fifth leg, including chela, much longer than left, the latter without any trace of an endopod____________________________ nerii (p. 146)
   The 2 fifth legs about equal in length; left leg with a rudimentary, 1-segmented endopod________________________________ aestiva (p. 147)

LABIDOCERA ACUTIFRONS (Dana)

FIGURE 98

Pontella acutifrons DANA, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 30, 1849.
Labidocera acutifrons GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 445, pls. 23, 41, 1892.

Occurrence.—Thirty males and females in surface tow south of Gay Head by Rathbun, September, 1883; 75 males and females in surface tow in Vineyard Sound by Rathbun, August, 1882; 200 males and females, including development stages from trawl wings, Stations 2074, 2093, 2195, 2230, *Albatross*, south of Nantucket and Marthas Vineyard.

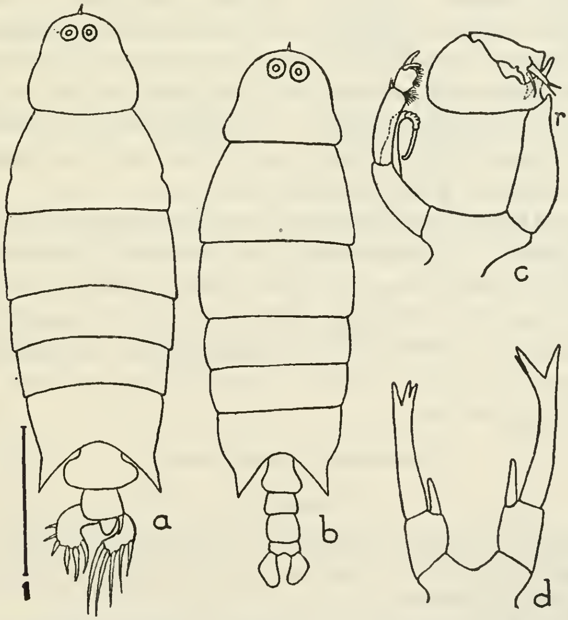

FIGURE 98.—*Labidocera acutifrons: a,* Female, dorsal; *b,* male, dorsal; *c,* male, fifth legs; *d,* female, fifth legs

Distribution.—Pacific Islands (Dana); tropical Altantic (Cleve); Gulf of Guinea (T. Scott); Mediterranean (Giesbrecht); Philippines, Australia (Brady); Atlantic and Antarctic Oceans (Wolfenden).

Color.—Body a light transparent blue, with a large area of dark blue in the posterior portion of the thorax. Eyes large, separated from each other, and dark red, appearing black by transmitted light.

Female.—Forehead with a crest; posterior corners of fifth segment with broad acuminate lobes extending diagonally outward and backward beyond the posterior margin of the genital segment; urosome one-fourth as long as metasome, very asymmetrical; genital segment swollen unevenly on the two sides; first abdominal segment with a dorsal spine at the right distal corner; second abdominal segment distorted to the right; caudal rami grossly curved and misshapen, the left one the larger, but with shorter setae; right fifth leg larger than left, endopods stout conical spines, exopods three times as long as endopods, each ending in three stout, divergent spines. Total length, 3.5–3.85 mm.

Male.—Body longer and more slender than that of the female; corners of fifth segment similar; urosome and caudal rami symmetrical, penultimate abdominal segment longer than any of the others; left fifth leg with a 1-segmented endopod half as long as the 2-segmented exopod and tipped with a curved filament; chela of right leg much swollen at the knuckle, the finger with a wide and angular flap on its inner surface. Total length, 3.75–4 mm.

Remarks.—All the localities here recorded, except the one in Vineyard Sound, are in or close to the Gulf Stream. They are the first record of the species from American shores, and are the farthest north of any records, although Wolfenden has reported specimens from the Antarctic Ocean. The extraordinary asymmetry of the female urosome and the details of the fifth legs in both sexes are distinguishing characters.

LABIDOCERA NERII (Krøyer)

FIGURE 99

Pontia nerii KRØYER, Naturh. Tidsskrift, ser. 2, vol. 2, p. 579, 1849.

Labidocera nerii GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 446, pls. 23, 25, 1892.

Occurrence.—Two females from trawl wings, Station 2092, *Albatross*, south of Marthas Vineyard.

Distribution.—Cape Finisterre (Krøyer); tropical Atlantic (Lubbock, Giesbrecht); Malay Archipelago (Cleve); Atlantic (Wolfenden).

Color.—No statement with reference to color has ever been made.

Female.—Posterior corners of fifth segment angular but not produced; urosome 2-segmented and one-fifth as long as metasome, and symmetrical; caudal rami short, triangular; fifth legs asymmetrical, left larger than right, endopods rudimentary, little more than knobs, exopods 1-segmented, each ending in three unequal spines, with two minute spinules on the outer margin. Total length, 2.75–3 mm.

Male.—Body shorter and narrower than that of the female; posterior corners of fifth segment produced into short lobes; urosome longer and narrower than in the female, and symmetrical; right fifth leg longer than left, hand of chela only moderately stout, with two thumbs, side by side and equal in length, and a strongly curved finger, which shuts down between the thumbs; end segment of left leg conical. Total length, 2.5–2.75 mm.

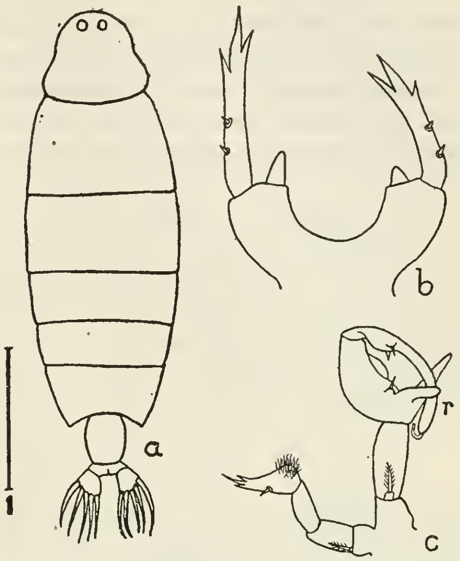

FIGURE 99.—*Labidocera nerii: a,* Female, dorsal; *b,* female, fifth legs; *c,* male, fifth legs (after Giesbrecht)

Remarks.—This is a rare species and does not occur anywhere except in very small numbers; it has not before been reported from American shores. It may be distinguished by the 2-segmented symmetrical urosome of the female and by the fifth legs of both sexes.

LABIDOCERA AESTIVA Wheeler

FIGURE 100

Labidocera aestiva WHEELER, Bull. U. S. Fish. Comm. 1899, vol. 19, p. 178, fig. 16, 1900.

Occurrence.—One female in surface tow on Georges Bank, September, 1872; 500 males and females in surface tow in Vineyard Sound, August, 1875; 2,500 males and females by V. N. Edwards in Vineyard Sound, December, 1877; 1,500 males and females by Rathbun in Vineyard Sound, August, 1881, August, 1882, October, 1882; 3,000 males and females by V. N. Edwards in Great Harbor, Woods Hole, September, 1887; 5 females in surface tow, Newport Harbor, by Rathbun, September, 1880; 9 males and females from trawl wings, Stations 955 to 960, *Fish Hawk*, off Nyes Neck, Buzzards Bay.

Distribution.—Gulf of St. Lawrence (T. Scott, Willey); Northumberland Strait (Willey); Gulf of Maine (Bigelow); Woods Hole Harbor (Fish).

Color.—Over a white background the body is slightly greenish and translucent, the color not evenly diffused but confined chiefly to the central and lower portions of the body. A spot of dingy yellow near the head, another in the caudal segments, and sometimes a third near the center. The two elongate oval eye spots, close together and sometimes apparently touching, near the anterior margin of the head, are jet black. Back of them on the ventral surface between the bases of the first antennae is a large transversely elliptical spot of a deep claret color, appearing black in certain lights. This is the ventral eye and forms a raised prominence on the ventral surface of the head. The first antennae are perfectly transparent, but show a faint bluish tint by transmitted light. The mouth parts also sometimes show a similar bluish tint. (Rathbun.)

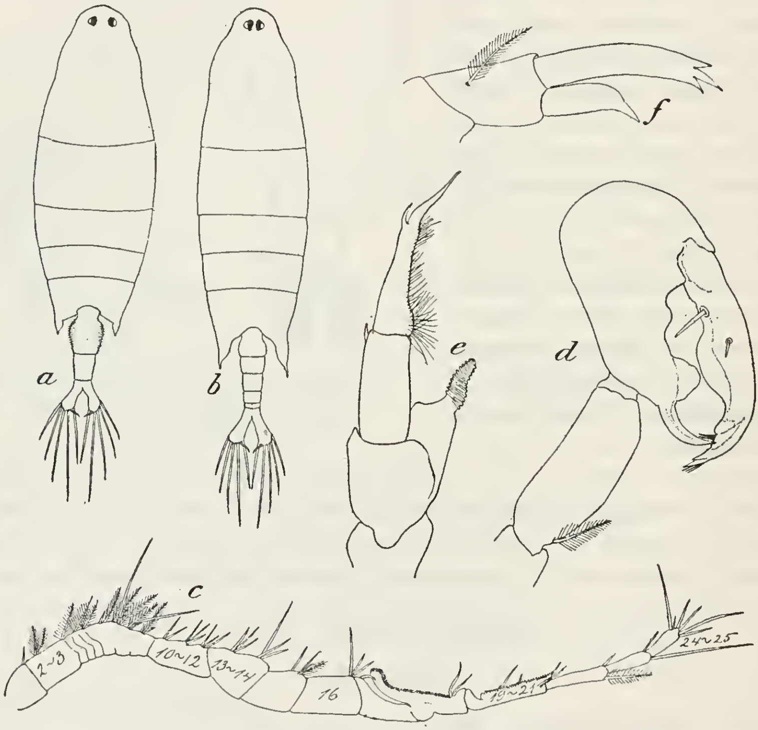

FIGURE 100.—*Labidocera aestiva:* *a*, Female, dorsal; *b*, male, dorsal; *c*, male, right first antenna; *d*, *e*, male, fifth legs; *f*, female, fifth leg. (From W. M. Wheeler)

Female.—Head evenly rounded anteriorly; corners of fifth segment symmetrical, reaching the center of the genital segment; urosome 2-segmented, symmetrical, the genital segment much longer than the abdomen, its sides covered with short hairs; caudal rami two and one-half times as long as wide; fifth legs symmetrical, rami

1-segmented, exopod ending in three stout spines, endopod in a single acuminate point. Total length, 1.75–2 mm.

Male.—Longer and narrower than the female; eyes closer together; corners of fifth segment asymmetrical, the right one the longer and reaching nearly the center of the second abdominal segment; urosome symmetrical; right fifth leg slightly longer than the left, hand of chela on right leg swollen distally, thumb single, slender, sickle-shaped, finger swollen in the center; endopod of left leg short, 1-segmented, ending in a corrugated knob. Total length, 1.8–2.2 mm.

Remarks.—This is evidently one of the most common copepods in the area and is found mostly at the surface. Fish mentioned it as one of the most common summer forms in Woods Hole Harbor, and the specific name given it by Wheeler might seem to restrict it to that season of the year, but Edwards found it abundant out in Vineyard Sound in winter. The asymmetry of the lobes on the fifth segment of the male and the fifth legs in both sexes are the most easily recognized characters.

Genus PONTELLA Dana, 1846

Head with lateral hooks, but usually without a crest and separated from the first segment; one pair of dorsal cuticular lenses and a single rostral lens in front of the ventral eye; fifth segment separated from the fourth, usually with pointed lobes at the corners, often asymmetrical in the female; urosome 2- or 3-segmented in female and asymmetrical, 4- or 5-segmented in the male and symmetrical; exopods of first four pairs of legs 3-segmented, endopod of first leg 3-segmented, of second, third, and fourth legs 2-segmented; fifth legs biramose in female, uniramose in male; right antenna of male geniculate.

KEY TO THE SPECIES

FEMALES

1. Right posterior corner of fifth segment with a long curled and ragged streamer trailing backward far behind tips of caudal setae-- pennata (p. 150)
   No streamer, but pointed asymmetrical lobes on corners of fifth segment-- 2
2. Left lobe on fifth segment acuminate and reaching to or beyond bases of caudal rami; urosome 2-segmented------------------------------ 3
   Left lobe on fifth segment scarcely reaching distal margin of genital segment; urosome 3-segmented------------------------------------ 4
3. Base of rostrum swollen into a large sphere; right caudal ramus much enlarged; genital segment with several outgrowths- securifer (p. 151)
   Base of rostrum scarcely swollen at all; right caudal ramus enlarged but little; one outgrowth on genital segment---- spinipes (p. 152)
4. Left lobe on fifth segment wider than long, the point turned outward; exopod of fifth leg with a smooth inner margin---- meadii (p. 153)
   Left lobe on fifth segment longer than wide, the point turned backward; fifth exopod with a large spine on inner margin--- -- lobiancoi (p. 154)

MALES

1. Apical spines of left fifth leg obtuse; hand of chela on right leg with a single laminate process between bases of thumb and finger ---- **lobiancoi** (p. 154)
   Apical spines of left leg acuminate; hand of chela with 2 processes between the bases of thumb and finger ---- 2
2. End segment of left fifth leg with 2 equal apical spines, 2 on outer margin, and rows of long hairs on posterior surface ---- **securifer** (p. 151)
   End segment of left fifth leg with 1 large apical spine, 2 much smaller ones at its base and no rows of hairs ---- 3
3. Second basipod of right leg as long as hand of chela; finger just meeting tip of thumb ---- **meadii** (p. 153)
   Second basipod of right leg much shorter than hand of chela; finger extending considerably beyond tip of thumb ---- **pennata** (p. 150)

PONTELLA PENNATA Wilson

Figure 101

Pontella pennata Wilson, Proc. U. S. Nat. Mus., vol. 80, art. 15, p. 27, pl. 1, 1932.

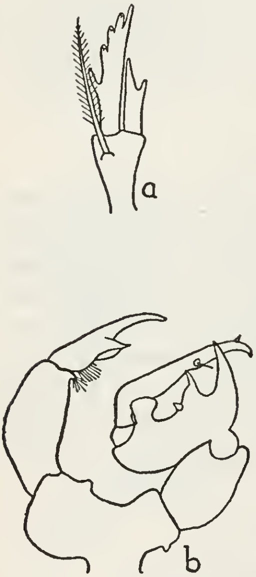

Figure 101.—*Pontella pennata: a,* Female, fifth leg; *b,* male, fifth legs

Occurrence.—One female in surface tow, Vineyard Sound, August, 1881; 10 males and females in Great Harbor, Woods Hole, by V. N. Edwards, September, 1887.

Distribution.—Chesapeake Bay (Wilson); Woods Hole Harbor (Fish).

Color.—Body fairly transparent and deep blue with a greenish tinge, the color darker at the joints of the appendages, especially those of the fifth legs in the male, and in the grooves between the body segments. The swollen middle section of the grasping antennae of the male also shows the same dark-blue color.

Female.—Body stout and cylindrical; left posterior lobe of the fifth segment larger than the right; dorsal surface of the genital segment with a chitin outgrowth on either side of the mid line, which passes forward onto the dorsal surface of the thorax, and from the right one a ragged streamer as long as the entire body extends backward; urosome 2-segmented and very short; caudal rami symmetrical; fifth legs much reduced in size, the endopod four-fifths as long as the exopod and tipped with two unequal spines. Total length, 3–3.25 mm.

Male.—Lobe at right posterior corner of fifth segment larger than the left and bifurcate at its tip; urosome 4-segmented, symmetrical; no outgrowths on dorsal surface of genital segment; fifth legs large, reaching nearly to the tips of the caudal setae; left one tipped with a stout spine having two others at its base on the inside; second basipod of right fifth leg shorter than the hand of the chela; finger of chela reaching considerably beyond the thumb. Total length, 3–3.5 mm.

Remarks.—The long ragged streamer trailing backward from the right side of body in the female and the size and form of the fifth legs in the male are the best means of identification. The species is probably common along the Atlantic coast at least as far south as Chesapeake Bay.

PONTELLA SECURIFER Brady

FIGURE 102

Pontella securifer BRADY, Voyage of H. M. S. *Challenger*, vol. 8, pt. 23, Copepoda, p. 96, pl. 45, 1883.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 461, pls. 24, 40, 1892.

Occurrence.—Twelve males and females in a surface tow, Station 2223, *Albatross*, south of Nantucket.

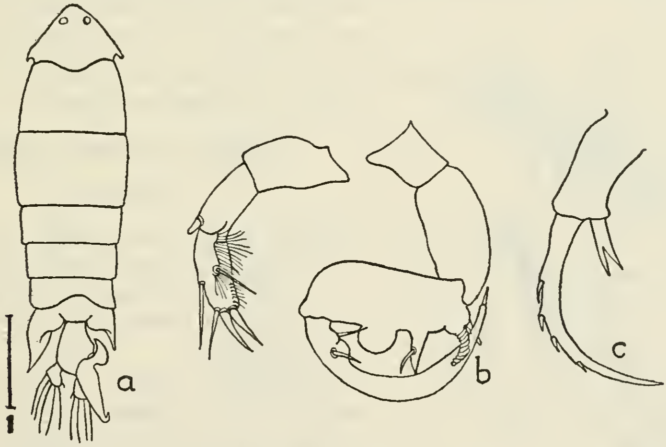

FIGURE 102.—*Pontella securifer: a,* Female, dorsal; *b,* male, fifth legs; *c,* female, fifth leg

Distribution.—Tropical Pacific (Brady); Malta (Thompson); Gulf of Guinea (T. Scott); tropical Atlantic and Pacific (Giesbrecht); Indian Ocean, Ceylon (Thompson and Scott); Bay of Bengal (Sewell); Atlantic and Indian Oceans (Wolfenden); South African seas (Cleve, Stebbing); Malay Archipelago (A. Scott).

Color.—Apparently no author reporting this species has seen anything but preserved material, and no color statement has been made.

Female.—Base of rostrum swollen into a conspicuous sphere, made up of two rostral lenses whose inner walls touch each other; corners of fifth segment asymmetrical, the left lobe reaching the center of the caudal rami, both lobes mucronate; urosome 2-segmented, the genital segment prolonged backward and entirely covering the abdomen in dorsal view, with two or three fingerlike outgrowths on the dorsal surface; right caudal ramus larger than left; endopod of fifth leg very short, tipped with two equal spines, exopod curved strongly inward, ending in a single acuminate point, with four small outer spinules. Total length, 4.25–4.5 mm.

Male.—Body shorter and narrower than in the female; corners of fifth segment symmetrical and not reaching the distal margin of genital segment; urosome 5-segmented, nearly symmetrical, the left caudal ramus slightly the larger; end segment of left fifth leg with two equal apical spines, two outer spines more slender but nearly as long, and rows of long hairs on the posterior surface; hand of chela on right leg with a curved and corrugated process at the proximal corner, and two processes on the inner margin, one long and pointed, the other semicircular. Total length, 3.85–4.1 mm.

Remarks.—This species is readily recognized by the swollen rostrum, which is distinctly reddish in alcoholic specimens, by the asymmetry of the fifth segment and urosome, and by the fifth legs. It has not been reported previously from our American shores.

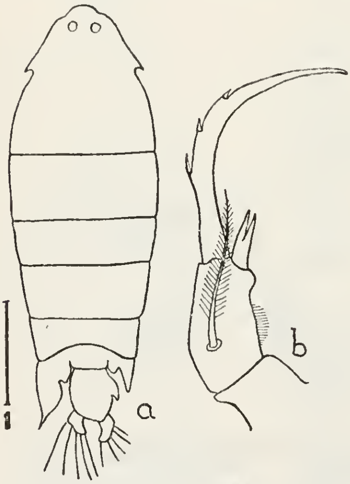

FIGURE 103.—*Pontella spinipes: a,* Female dorsal; *b,* female, fifth leg

PONTELLA SPINIPES Giesbrecht

FIGURE 103

Pontella spinipes GIESBRECHT, Atti Accad. Lincei, Rome, ser. 4, vol. 5, sem. 2, p. 28, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, p. 462, pls. 24, 40, 1892.

Occurrence.—One female from surface tow, Station 1107, *Fish Hawk*, south of Nantucket.

Distribution.—Indian Ocean (Giesbrecht); Atlantic (Wolfenden); Antarctic Ocean (T. Scott).

Color.—General color reddish brown, the antennae and mouth parts colorless and completely transparent.

Female.—Body rather short and stout; left posterior lobe of the fifth segment conspicuously larger than the right and reaching the tips of the caudal rami; urosome 2-segmented, the abdominal segment entirely covered dorsally by the overhanging genital segment; one outgrowth on the dorsal surface of the latter; right caudal ramus a little larger than the left, but with shorter setae; dorsal surface of genital segment transversely corrugated; the genital opening protruding and twisted to the right; endopod of fifth legs very short, with two equal apical spines; exopod elongate, acuminate, curved strongly inward, with three small spinules on the outer margin. Total length, 4.8 mm.

Male.—Unknown.

Remarks.—This species may be identified by the large left lobe of the fifth segment, the asymmetry of the genital segment and caudal rami, and the long and strongly curved exopods of the fifth legs. This is the first record of the species from our American shores.

PONTELLA MEADII Wheeler

FIGURE 104

Pontella meadii WHEELER, Bull. U. S. Fish Comm. 1899, vol. 19, p. 180, fig. 17, 1900.

Occurrence.—A male and a female in surface tow by Rathbun, Vineyard Sound, August, 1881; 50 males and females in surface tow in Great Harbor, Woods Hole, by V. N. Edwards, September, 1887.

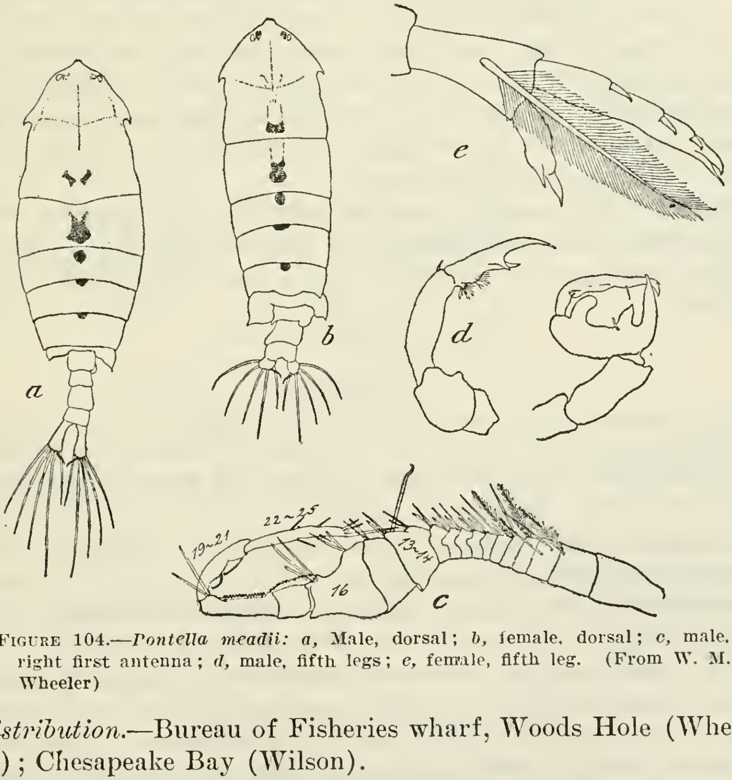

FIGURE 104.—*Pontella meadii: a,* Male, dorsal; *b,* female, dorsal; *c,* male, right first antenna; *d,* male, fifth legs; *e,* female, fifth leg. (From W. M. Wheeler)

Distribution.—Bureau of Fisheries wharf, Woods Hole (Wheeler, Fish); Chesapeake Bay (Wilson).

Color.—Body dark bluish green, especially on the head, the abdomen, and along the edges of the cephalothorax; dorsal portions of head silvery white, more or less washed with green, and along the sides with some reddish pigment. Along the dorsal midline is a series of black blotches, one on each segment, the one on the head sometimes separated into two. There is also some black pigment along the sides of the posterior metasome; the chitin of the ventral surfaces and appendages is pale green; the eye is deep claret. (Wheeler.)

Female.—Body short and stout; left posterior lobe of fifth segment larger than the right, its tip pointed outward and not reaching behind the genital segment; urosome 3-segmented, asymmetrical, the genital segment with a process at its right posterior corner, the first abdominal segment with one at its left posterior corner; caudal rami nearly symmetrical; endopod of fifth legs half as long as exopod, with two unequal apical spines, exopod with two equal apical spines and three smaller ones on the outer margin. Total length, 2.35–2.65 mm.

Male.—Rostral lens thickened; fifth segment usually and urosome always symmetrical, except that the genital opening is on the left side; caudal rami long and narrow; left fifth leg longer than right, its end segment tipped with one large spine and two smaller ones at its base; hand of chela on right leg with a sharply pointed thumb at the proximal corner and two processes on the inner margin, well separated from each other; finger just reaching the tip of the thumb. Total length, 2.75–3 mm.

Remarks.—This seems to be a southern form that appears within the present area during summer. It may be identified by the row of black spots along the dorsal midline and by the details of the fifth legs.

PONTELLA LOBIANCOI (Canu)

FIGURE 105

Pontellina lobiancoi CANU, Bull. Sci. France et Belgique, vol. 19, p. 101, pls. 8, 9, 1888.

Pontella lobiancoi GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 461, pls. 24, 40, 1892.

Occurrence.—One female from surface tow, Station 10236, *Grampus*, northeast of Cape Cod.

Distribution.—Wimereaux (Canu); Gibraltar, Naples (Giesbrecht); Adriatic (Steuer, Pesta); Irish Seas (A. Scott).

Color.—Body varying shades of blue, in places having a greenish tint, with a row of oval or rounded spots much darker in color along the dorsal midline in the head and first three thoracic segments.

Female.—Body relatively narrower than in the other species; posterior corners of fifth segment with symmetrical lobes reaching the center of the genital segment; urosome 3-segmented, the genital segment and caudal rami slightly asymmetrical; endopod of fifth legs less than half the length of the exopod, with two apical spines of equal length, the inner one acuminate, the outer one blunt; exopod with two very unequal spines at the tip, three smaller ones on the outer margin, and one larger one on the inner margin. Total length, 3.95–4.25 mm.

Male.—Right lobe on fifth segment longer than left; urosome 5-segmented, the genital segment enlarged on the left side, the other segments and the caudal rami symmetrical; left fifth leg ending in three processes, the two outer ones blunt, the inner one widened and flattened, its inner margin fringed with minute setae; thumb of chela on right leg nearly as long as finger, the hand with a single flat and rounded process at the center. Total length, 3.33–3.75 mm.

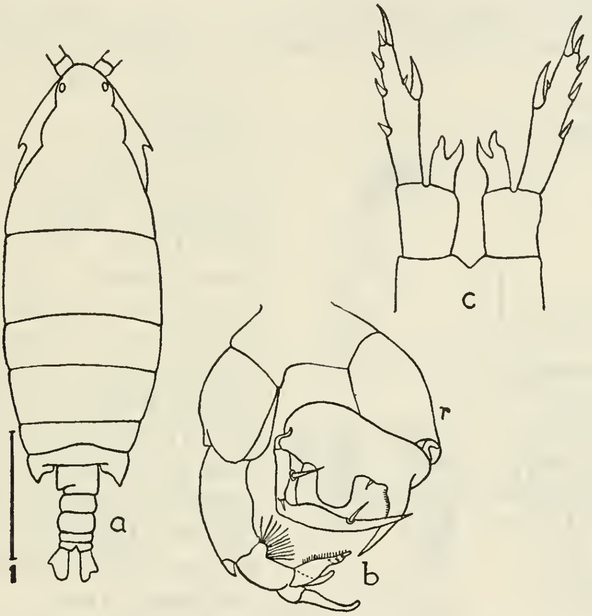

FIGURE 105.—*Pontella lobiancoi: a,* Male, dorsal (after Giesbrecht); *b,* male, fifth legs; *c,* female, fifth legs

Remarks.—This species can be recognized by its near approach to symmetry and by the details of the fifth legs, especially those of the male. It has not been reported before from our American coasts, and its distribution would seem to indicate that it is a tropical species that comes north in the Gulf Sream.

Genus PONTELLINA Dana, 1853

Head separated from the first segment; fifth segment fused with the fourth, with sharp-pointed lobes at the posterior corners; metasome a little more than half as wide as long, narrowed anteriorly; urosome 2-segmented, one-third as long as metasome; exopods of first four pairs of legs 3-segmented; endopod of first legs 3-segmented, of second, third, and fourth legs 2-segmented; fifth legs biramose in female, uniramose in male. A single species found in the present area.

PONTELLINA PLUMATA (Dana)

FIGURE 106

Pontella plumata DANA, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 27, 1849.
Pontellina plumata GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 497, pls. 25, 40, 1892.

Occurrence.—Three females from trawl wings, Station 2195, *Albatross*, south of Nantucket; one female in surface tow, Station 2204, *Albatross*, south of Marthas Vineyard.

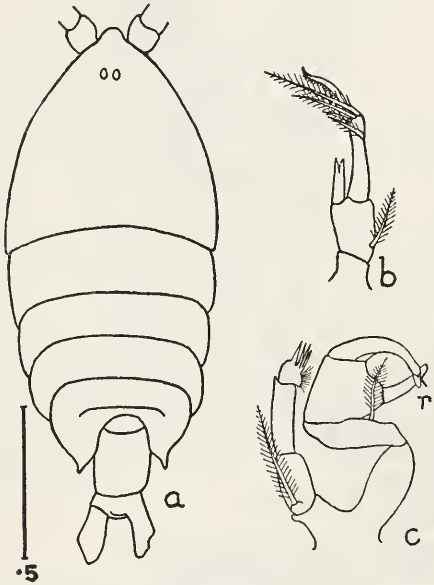

FIGURE 106.—*Pontellina plumata: a*, Female, dorsal (after Giesbrecht); *b*, female, fifth leg; *c*, male, fifth legs

Distribution.—Tropical Atlantic, Cape of Good Hope, Kingsmill Islands (Dana); East Indies (Lubbock); Messina (Claus); Fiji Islands, Philippines (Brady); Malta (Thompson); Atlantic and Indian Oceans (Wolfenden); Bay of Bengal (Sewell); Malay Archipelago (A. Scott); Gulf of Suez, Indian Ocean, Ceylon (Thompson and Scott); tropical Atlantic and Pacific, Mediterranean (Giesbrecht); northern Atlantic (Cleve); South African coast (Stebbing).

Color.—Body a light violet-gray, deeper through the center of the metasome and along the posterior margins of the first and second thoracic segments. A large spot of deep purple, surrounded by a margin of orange-red, occupies the center of these two segments and extends forward into the head, and backward into the third segment. Setae of the appendages and of the caudal rami, and in the male the end segments of the first antennae and the enlarged portion of the grasping antenna, also orange-red. Each eye bordered on the inner side with a half circle of ruby red (Rathbun).

Female.—Posterior corners of fifth segment reaching beyond the center of the genital segment and nearly symmetrical; genital segment three times as long as the anal segment; the right caudal ramus fused with the anal segment, the left one distinctly separated; endopod of fifth legs less than half as long as exopod and ending in two acute equal processes; exopod 1-segmented, squarely truncated distally and armed with three unequal terminal setae, with a smaller one on the outer margin. Total length, 1.6–1.75 mm.

Male.—Posterior corners of fifth segment shorter; urosome 5-segmented and symmetrical; right first antenna geniculate, the swollen portion very short and nearly spherical; fifth legs each 4-segmented, the left one tipped with four slender spines of equal length; hand of chela on right leg with a long conical thumb, but without any process between the thumb and finger, so characteristic of *Pontella*. Total length, 1.5–1.65 mm.

Remarks.—This species may be recognized by the comparative width of the body, the symmetry of the fifth segment and the urosome, and the details of the fifth legs in both sexes. It has never before been reported from American shores and is probably an inhabitant of the warmer portions of the oceans.

Genus PONTELLOPSIS Brady, 1883

Head separated from the first segment, without cuticular lenses and lateral hooks; fourth and fifth segments fused with pointed posterior processes, asymmetrical in the male; urosome of female 1- or 2-segmented, of male 5-segmented, asymmetrical in both sexes; exopods of first four pairs of legs 3-segmented; endopod of first legs 3-segmented, of second, third, and fourth legs 2-segmented; fifth legs biramose in female, uniramose in male; right antenna geniculate. One species found here.

PONTELLOPSIS REGALIS (Dana)

FIGURE 107

Pontella regalis DANA, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 31, 1849.
Monops regalis GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 486, pls. 1, 26, 41, 1892.

Occurrence.—One male in surface tow on Georges Bank, September, 1874; three females in surface tow, Stations 2092, 2711, *Albatross;* four males and females from trawl wings, Station 2195, *Albatross*, south of Nantucket; one male, surface tow, Gulf Stream south of Marthas Vineyard.

Distribution.—Mediterranean, tropical portions of Atlantic, Pacific, and Indian Oceans (Giesbrecht); southern Atlantic (Brady); Malay Archipelago (Cleve, A. Scott); middle Atlantic (Lubbock); Malta (Thompson); Atlantic (Wolfenden); Bay of Bengal (Sewell); Messina (Thompson and Scott); Adriatic (Pesta).

Color.—Body greenish yellow, opaque, with spots of dark greenish blue on the front and sides of the head, and a row along either side of the thorax in the grooves between the segments; tips of the first antennae reddish. Blue, violet, brown, yellow, red, and green pigments are scattered in varying proportions and intensities through the body and the appendages. Often these colors are sharply differentiated and give the copepod an unusually gaudy appearance. Traces of these colors are still visible in the Georges Bank male recorded above, even after 50 years' immersion in alcohol.

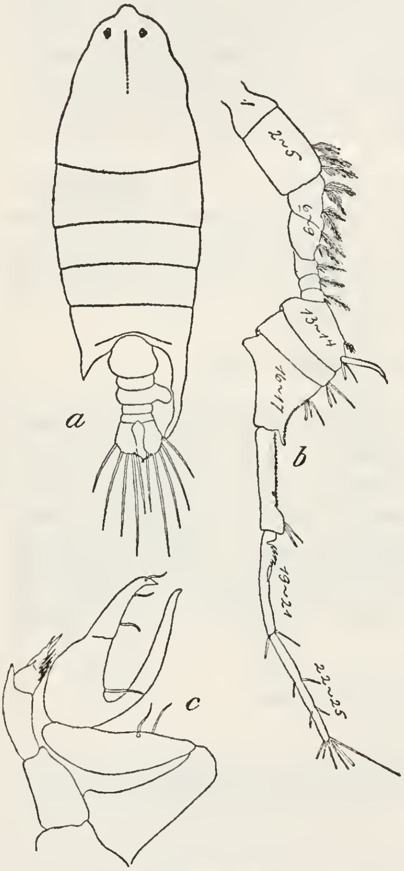

FIGURE 107.—*Pontellopsis regalis: a,* Male, dorsal; *b,* male, right first antenna; *c,* male, fifth legs. (From W. M. Wheeler)

Female.—Metasome a little more than twice as long as wide, much narrowed anteriorly, very little posteriorly; posterior lobes of fifth segment symmetrical, reaching beyond the center of the genital segment; urosome 2-segmented, asymmetrical, the genital segment twisted to the right; left caudal ramus larger than right; endopod of fifth legs short, tipped with two pointed processes of equal length; exopod three times as long as endopod, curved and tipped with two unequal spines, with a larger spine on the inner margin and three minute spinules on the outer margin. Total length, 4–4.5 mm.

Male.—Head asymmetrical, swollen on the right side; right corner of fifth segment much longer than left, reaching the center of the caudal rami; a knoblike process on the right side of the second abdominal segment; genital opening on the left side; caudal rami symmetrical; left fifth leg 5-segmented, tipped with two or three unequal spines; thumb of chela on right fifth leg longer than finger, no processes on the hand. Total length, 3.25–3.5 mm.

Remarks.—This species can be distinguished by the conspicuous asymmetry in both sexes, by the lack of cuticular lenses and lateral hooks on the head, and by the fifth legs. This is a tropical form that only occasionally wanders this far north in the Gulf Stream.

Family ACARTIIDAE

Genus ACARTIA Dana, 1846

Metasome spindle-shaped, strongly narrowed at both ends; urosome one-third as long as metasome; genital segment as long as the two abdominal segments combined; exopods of first four pairs of legs 3-segmented, endopods 2-segmented; fifth legs uniramose in both sexes, symmetrical in the female, the last segment spiniform or setiform, asymmetrical in the male, the right leg the larger.

KEY TO THE SPECIES

FEMALES

1. Posterior corners of fifth segment produced into short, stout spines; end segment of fifth leg half as long as plumose seta on preceding segment; its distal third densely toothed---- danae (p. 160)
   Posterior corners of fifth segment smoothly rounded, spines lacking or on the dorsal surface of the segment---------------------- 2
2. Front of head carrying 2 tentacular filaments below-------------------- 3
   Front of head without any trace of tentacular filaments below----------- 4
3. Caudal rami scarcely longer than wide; end segment of fifth legs stout and as long as plumose seta on preceding segment, toothed at center, then abruptly narrowed--------------- tonsa (p. 160)
   Caudal rami twice as long as wide; end segment of fifth legs stout, evenly tapered, ciliated, and as long as plumose seta on preceding segment--------------------- -------------- bifilosa (p. 162)
4. Caudal rami dilated into spheres, nearly as wide as long; their setae conspicuously dilated at their bases----------- discaudata (p. 163)
   Caudal rami normal laminae, setae not dilated------------------------- 5
5. End segment of fifth legs stout, straight, and as long as plumose seta on preceding segment------------------------------ clausii (p. 164)
   End segment of fifth legs slender, bent at the center, and much longer than plumose seta on preceding segment------ longiremis (p. 165)

MALES

1. Front of head carrying 2 tentacular filaments below-------------------- 2
   Front of head without any trace of tentacular filaments below---------- 3
2. Second segment of right fifth leg notched and armed with a short spine, end segment of left leg with angular process, both on inner margin--------------------------------------- bifilosa (p. 162)
   Second segment of right fifth leg and end segment of left leg with smooth inner margins------------------------------ tonsa (p. 160)
3. Right fifth leg more than twice as long as left, the first 2 free segments at the base very unequal in length--------- discaudata (p. 163)
   Right fifth leg but little longer than the left; the first 2 free segments at the base subequal in length------------------------------- 4
4. End segment of right fifth leg stout, considerably swollen in the middle, its outer margin perfectly smooth---------- longiremis (p. 165)
   End segment of right fifth leg slender, but little swollen in middle, its outer margin armed with 3 to 5 spines--------------- clausii (p. 164)

ACARTIA DANAE Giesbrecht

FIGURE 108

Acartia danae GIESBRECHT, Atti Accad. Lincei, Rome, ser. 4, vol. 5, sem. 2, p. 26, 1889; Fauna und Flora des Golfes von Neapel, vol. 19, p. 508, pls. 30, 43, 1892.

Occurrence.—Three females from trawl wings, Stations 2195, 2236, *Albatross*, south of Nantucket and Marthas Vineyard.

Distribution.—Tropical Atlantic and Pacific (Giesbrecht); northern Atlantic (Cleve); South African coast (Cleve, Stebbing); Banda Sea (A. Scott); Bay of Bengal, Gulf of Manaar (Sewell).

Color.—Body colorless and fairly transparent, sometimes with a slight bluish tinge around the mouth and the mouth parts.

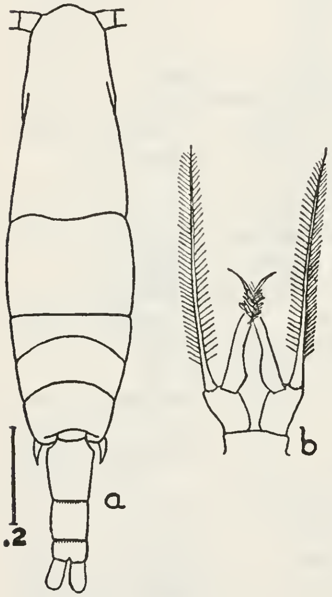

FIGURE 108.—*Acartia danae*: *a*, Female, dorsal (after Giesbrecht); *b*, female, fifth legs

Female.—Body narrow and elongate; fifth segment with short spines at the corners; urosome one-third the length of the metasome; genital and first abdominal segments with minute spinules along their posterior margins; first antennae reaching the tips of the caudal rami; second segment of fifth legs longer than wide; end segment swollen at its base, stoutly toothed distal to its center, and less than half as long as the slender plumose seta of the second segment. Total length, 1–1.2 mm.

Male.—Reported by Steuer as discovered in the material of the Valdivia Expedition, but not yet described.[6]

Remarks.—This species is the only one in the present area that has spines at the posterior corners of the fifth segment. The exceptional length and slenderness of the plumose setae on the second segments of the fifth legs are also characteristic. It has never before been reported from our American shores.

ACARTIA TONSA Dana

FIGURE 109

Acartia tonsa DANA, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 26, 1849.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 508, pls. 30, 43, 1892.

Occurrence.—Surface tow, Vineyard Sound, August, 1881; surface tow, Woods Hole Harbor, September, 1881; surface tow off wharf of Bureau of Fisheries, in Cuttyhunk Harbor, in the Eel Pond, in Green Pond and Great Pond, Falmouth; from trawl wings, Stations 955 to 961, *Fish Hawk*, by Rathbun, in Buzzards Bay; surface tow in John Pond, Falmouth, and Great Pond, Barnstable; in Waquoit Bay, Falmouth, and the small pond at the head of the bay; on Marthas Vineyard in small pond near Oak Bluffs, Farm Pond, Sengekontacket Pond, Nashaquitsa Pond, and Edgartown Great Pond; on Chappaquiddick Island in Poucha Pond and two of the small ponds along the shore of Katama Bay; in Gosnold Pond on Cuttyhunk Island; in West End Pond on Naushon Island.

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[6] Zool. Anz., vol. 45, no. 9, p. 397, 1915.

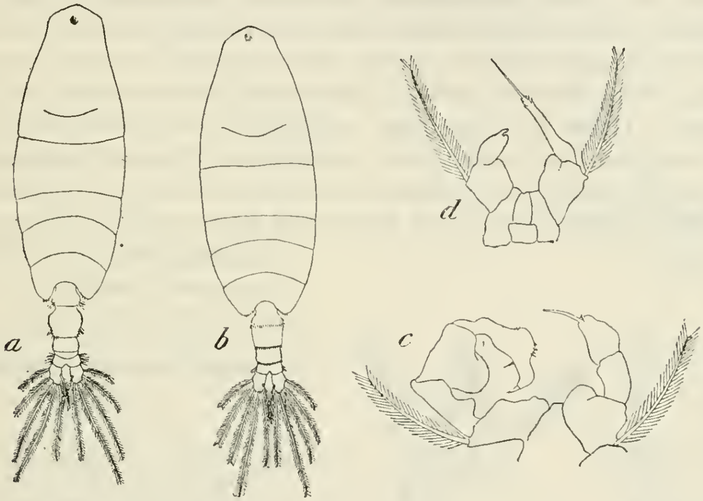

FIGURE 109.—*Acartia tonsa: a,* Male, dorsal; *b,* female, dorsal; *c,* male, fifth legs; *d,* female, fifth legs. (From W. M. Wheeler)

Distribution.—Tropical Pacific (Giesbrecht); Australia (Dana); North Atlantic (Cleve); California coast (Esterly); Narragansett Bay (Williams); Woods Hole (Wheeler, Fish).

Color.—Body translucent to transparent, with a faint bluish or greenish tinge, just strong enough to make the living copepods visible over a dark background. Sometimes a bluish, greenish, or whitish pigment forms a few scattered spots, especially on the ventral surface around the bases of the mouth parts and the swimming legs. The eye spot is black in the center, but shows red around the edges. In the male the eye is farther back than in the female and dark red, and there is a patch of brown at the base of the mouth parts.

Female.—Corners of fifth segment smoothly rounded, without spines; urosome one-third as long as metasome; genital segment as long as the abdomen and caudal rami combined; anal segment hairy on each lateral margin; second segment of fifth legs as wide as long; end segment swollen proximally, coarsely toothed centrally, abruptly narrowed distally, as long as the plumose seta on the second segment; spermatophore sausage-shaped. Total length, 1.25–1.5 mm.

Male.—Urosome 5-segmented, but the penultimate segment is very short and often poorly defined; genital orifice on left side; fifth legs made up of a common median piece, the fused first basipods, a right ramus, 4-segmented, and a left ramus, 3-segmented; end segment of right leg claw-shaped, swollen in the middle, and forming an imperfect chela by shutting against a wide process on the inner margin of the penultimate segment. Total length, 1–1.15 mm.

Remarks.—Wheeler's statement that this is one of the commonest copepods at Woods Hole during the summer months still holds true. From the list of localities within the present area where it has been found it is evident that the species can adapt itself to any degree of salinity. Its presence in such fresh-water lakes as John Pond and Barnstable Great Pond suggests an ability for active migration up the rivers forming the outlets to such ponds. A careful comparison of structural details and a series of measurements of specimens taken from fresh, brackish, and salt water, like those made by Ekman for *Limnocalanus grimaldii* and *L. macrurus*[7] would undoubtedly yield interesting results.

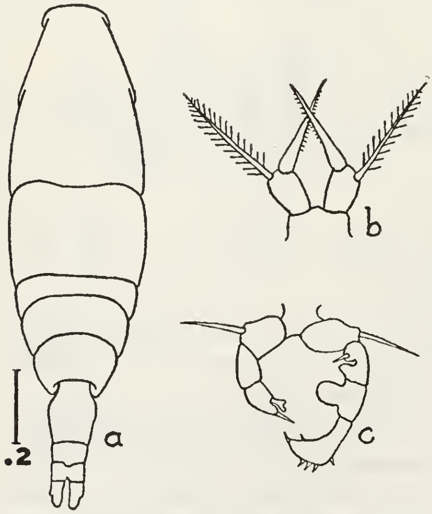

FIGURE 110.—*Acartia bifilosa: a*, Female, dorsal (after Giesbrecht); *b*, female, fifth legs; *c*, male, fifth legs

ACARTIA BIFILOSA (Giesbrecht)

FIGURE 110

Dias bifilosus GIESBRECHT, Zool. Anz., vol. 4, p. 257, 1881.

Acartia bifilosa GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 507, pl. 43, 1892.

Occurrence.—Surface tow, Vineyard Sound, December, 1887; recorded by Fish as common in Woods Hole Harbor from December to June.

Distribution.—British seas (T. Scott, Brady); Mediterranean (Giesbrecht); Skager Rak (Cleve); tropical and northern Atlantic (Cleve); Helgoland (Claus, Timm); coast of Norway (Boeck); Baltic Sea (Lindström).

Color.—Body colorless and transparent with just enough of a whitish tinge to make the copepod visible over a dark background.

Female.—Corners of fifth segment rounded, without spines; urosome about one-third the length of the metasome; dorsal surface

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[7] Internat. Rev. Ges. H. und H., vol. 6, p. 355, 1913.

of genital segment and first abdominal segment covered with transverse rows of minute hairs; second segment of fifth legs longer than wide; end segment swollen at the base, acuminate distally and armed with minute hairs, but without teeth, the same length as the plumose seta on the second segment. Total length, 1–1.25 mm.

Male.—As long as the female but narrower; urosome 5-segmented, the penultimate segment well defined; second free segment of the right fifth leg with a deep invagination at the center of the inner margin, and proximal to it a stout spine; end segment of the left fifth leg with a terminal spine and a stout, angular process on the inner margin close to the tip. Total length, 1–1.25 mm.

Remarks.—According to Fish this species apparently disappears about the first of July and does not reappear until December. It may be recognized by the lack of teeth on the end segment of the fifth legs in the female, and by the invagination and angular process on the fifth legs of the male.

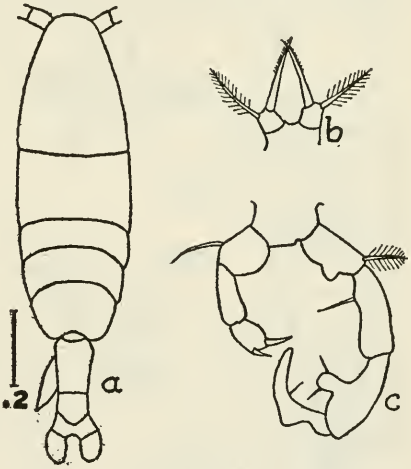

FIGURE 111.—*Acartia discaudata: a,* Female, dorsal (after Sars); *b,* female, fifth legs; *c,* male, fifth legs

ACARTIA DISCAUDATA (Giesbrecht)

FIGURE 111

Dias discaudatus GIESBRECHT, Vierter Ber. Comm. Unters. Deutsch. Meere, Jahrg. 7, p. 148, pls. 3, 5, 8, 9, 1882.

Acartia discaudata SARS, Crustacea of Norway, vol. 4, p. 152, pl. 102, 1903.

Occurrence.—Two females from small pond on eastern shore of Buzzards Bay in Falmouth near Quisset Harbor.

Distribution.—Baltic Sea (Giesbrecht); British seas (T. Scott); French coast (Canu); Norwegian coast (Sars); Helgoland (Claus); Kieler Föhrde (Giesbrecht); Gulf of Finland (Braun); Irish coast (Thompson); Boulogne sur Mer (Du Guerne).

Color.—Body a light bluish gray, semitransparent, and without pigment marks.

Female.—Head separated from the first segment; fourth and fifth segments fused, with rounded corners; genital segment much dilated across its anterior portion, with a large ventral protuberance twisted to the left; anal segment widened distally to support the large caudal rami, which are swollen into rounded bulbs, as wide as long, with the bases of their terminal setae considerably dilated; end segment of fifth legs as long as the seta on the preceding segment, enlarged basally, acuminate and fringed with minute hairs distally. Total length, 1.1–1.2 mm.

Male.—Body stout; genital segment neither dilated anteriorly nor protuberant ventrally; caudal rami of normal size, their setae not dilated; fifth legs larger than in the other species, the right leg more than twice as long as the left, its end segment slender, strongly curved and clawlike; second free segment much longer than the first, with a very small inner protuberance. Total length, 1–1.1 mm.

Remarks.—This species can be recognized by the size and shape of the caudal rami in the female, together with the dilated bases of the caudal setae and the ventral protuberance of the genital segment; in the male by the unequal length of the fifth legs. It does not seem to occur anywhere in such abundance as is common for the other species here enumerated.

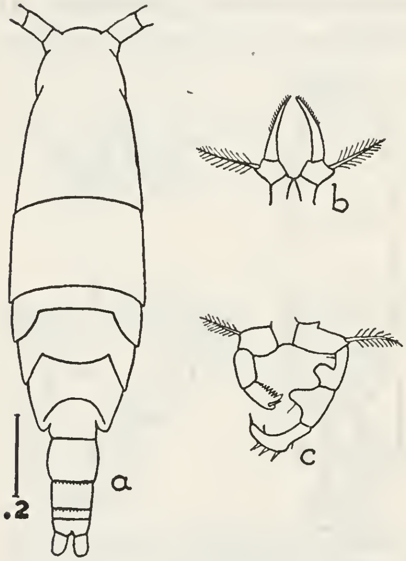

Figure 112.—*Acartia clausii: a,* Female, dorsal (after Giesbrecht); *b,* female, fifth legs; *c,* male, fifth legs

ACARTIA CLAUSII Giesbrecht

Figure 112

Acartia clausii Giesbrecht, Atti Accad. Lincei, Rome, ser. 4, vol. 5, sem. 2, p. 25, 1889.—Sars, Crustacea of Norway, vol. 4, p. 150, pl. 101, 1903.

Occurrence.—Surface tow, Hyannis Harbor, Newport Harbor, and Vineyard Sound by Rathbun; off the Bureau of Fisheries wharf by Fish; surface tow, Station 10331, *Grampus*, by Bigelow.

Distribution.—British Isles (T. Scott, Cleve); coast of France (Canu); Mediterranean, North Atlantic (Giesbrecht); Black Sea (Karawajew); Azores, North Sea (Cleve); Norwegian coast (Sars); Alaska, Nova Scotia, Passamaquoddy Bay (Willey); Messina, Nizza (Claus); Malta, Canary Islands (Thompson); Adriatic (Car, Pesta); northern Atlantic (Cleve); Narragansett Bay (Williams); Chesapeake Bay (Wilson); Gulf of Maine (Bigelow); Woods Hole (Fish).

Color.—So transparent and colorless as to be practically invisible over a white background, but with enough of a whitish cast to make them apparent over a black background (Rathbun).

Female.—No rostral filaments; corners of fifth segment without spines; genital and first abdominal segments with a row of small spinules across their dorsal posterior margins; end segment of fifth legs short and stout, swollen at its base and acute distally, where it is armed with a fringe of short hairs along the outer margin, but without teeth. Total length, 1.15–1.25 mm.

Male.—Body shorter and narrower than in the female, but with the urosome relatively longer and armed with similar dorsal spinules; end segment of right fifth leg narrow, strongly curved and armed with three or four small spines along its outer margin; end segment of left leg very small and tipped with a finger process and a short spine. Total length, 1–1.1 mm.

Remarks.—Bigelow found this species in the Gulf of Maine averaging a larger percentage in the shallow waters along shore than in deeper parts, but it does not attain sufficient abundance to constitute an important food supply. Farther south in Chesapeake Bay it occurs in exceptional abundance, and shows there the same ability for ready adaptation to differing degrees of salinity that is exhibited here by *tonsa.*

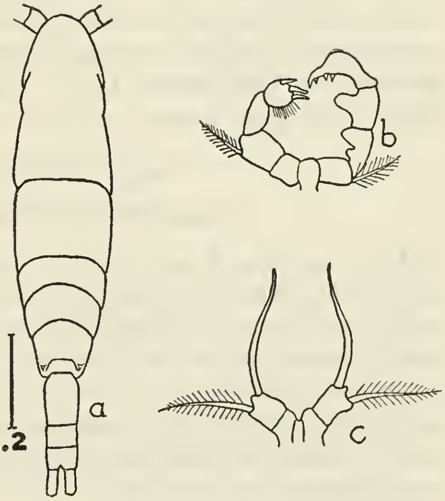

FIGURE 113.—*Acartia longiremis: a,* Female, dorsal (after Giesbrecht); *b,* male, fifth legs; *c,* female, fifth legs

ACARTIA LONGIREMIS (Lilljeborg)

FIGURE 113

Dias longiremis LILLJEBORG, De crustaceis ex ordinibus tribus: Cladocera, Ostracoda et Copepoda, in Scania occurrentibus, p. 181, pl. 24, 1853.

Acartia longiremis G. O. SARS, Crustacea of Norway, vol. 4, p. 149, pls. 99, 100, 1903.

Occurrence.—Both sexes in surface tow from Bureau of Fisheries wharf, August, 1923; obtained by Bigelow in surface tow, Station 10331, *Grampus.*

Distribution.—Faroe Islands, North Sea, Skager Rak (Cleve); Baltic Sea (Möbius); Gulf of Finland (Nordquist); northern Atlantic (Cleve); English seas (Brady, T. Scott); Mediterranean (Thompson and Scott); Norwegian coast (Sars); North Sea (van Breemen); Greenland (Stephensen); Arctic Ocean (Mrázek, Willey); Kieler Föhrde (Giesbrecht); Chesapeake Bay (Wilson); Gulf of Maine (Bigelow); Woods Hole (Fish).

Color.—Body extremely transparent, with a faint tinge of blue, enough to make it visible over either a white or a black background.

Female.—Metasome three times as long as wide, narrowed and obtusely truncated anteriorly; no tentacular filaments; corners of fifth segment rounded, but each armed on its dorsal surface with a delicate spinule; genital segment as long as the abdomen, protruding ventrally, armed on the sides and at the posterior margin with scattered spinules; caudal rami much longer than wide, slightly asymmetrical, the right one the larger; end segment of fifth legs very slender and elongate, definitely longer than the seta on the preceding segment and without hairs or teeth. Total length, 0.9–1.1 mm.

Male.—Smaller than female; metasome narrower, with similar spinules on the dorsal surface of the posterior corners; end segment of right fifth leg strongly swollen through the center, not much curved, with a smooth outer margin; end segment of left leg considerably swollen, fringed with long hair on its inner margin, and tipped with two stout spines. Total length, 0.8–1 mm.

Remarks.—This species may be recognized in the female by the exceptional slenderness of the last segment of the fifth legs and the fact that it is longer than the seta. In the male the dorsal spinules on the corners of the metasome afford a means of identification. In company with *clausii* this species forms the chief constituent of the plankton of Chesapeake Bay. Fish found it most abundant at Woods Hole from January to May, but it occurs also during summer.

Family TORTANIDAE

Genus TORTANUS Giesbrecht, 1898

Head separated from the first segment; fourth and fifth segments fused, with pointed processes in the female, without them in the male; caudal rami very unlike in the female, to a lesser degree in the male; exopods of the first four pairs of legs 3-segmented, endopods 2-segmented; fifth legs uniramose in both sexes, the right leg in the male tipped with a chela; endopod of first leg often 3-segmented in male; urosome 2- or 3-segmented in female, 5-segmented in male, conspicuously asymmetrical.

KEY TO THE SPECIES

FEMALES

1. End segment of fifth leg three or four times as long as penultimate segment, curved and acutely pointed, with smooth margins -- discaudatus (p. 167)
   End segment of fifth leg shorter than penultimate segment and blunt, 1 apical spine, 2 at inner corner, 1 at outer center -- setacaudatus (p. 168)

MALES

1. Fifth legs about same length; end segment of left leg no longer than penultimate segment; thumb of chela on right leg conical -- discaudatus (p. 167)
   Left fifth leg much longer than right, its end segment twice as long as penultimate segment; thumb of chela swollen into a sphere -- setacaudatus (p. 168)

TORTANUS DISCAUDATUS (Thompson and Scott)

Figure 114

Corynura discaudata Thompson and Scott, Proc. Liverpool Biol. Soc., vol. 12, p. 80, pl. 6, figs. 1, 10, 11, pl. 7, figs. 1, 2, 1897.

Tortanus discaudatus Giesbrecht and Schmeil, Das Tierreich, Lief. 6, Copepoda, p. 158, 1898.

Occurrence.—Both sexes in vertical net, Station 20103, *Grampus*, southeast of Nova Scotia; both sexes in surface tow at Menemsha Bight, Marthas Vineyard, August, 1926, by the present author.

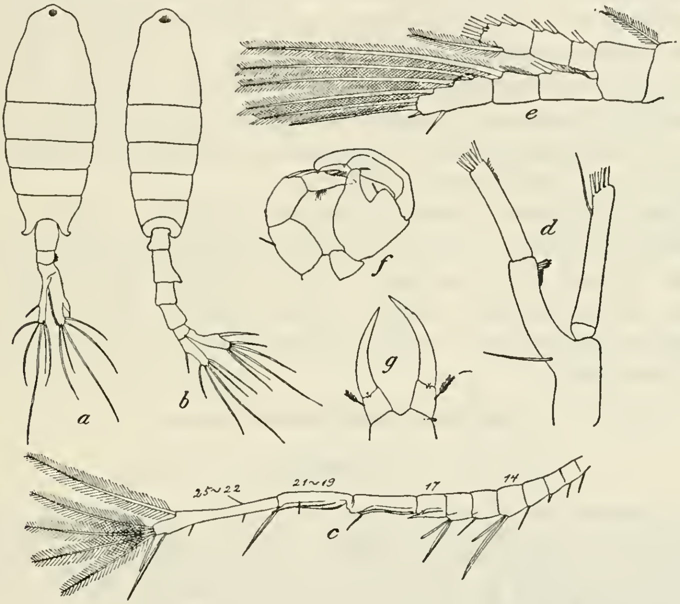

Figure 114.—*Tortanus discaudatus: a*, Female, dorsal; *b*, male, dorsal; *c*, male, right first antenna; *d*, male, second antenna; *e*, male, first leg; *f*, male, fifth legs; *g*, female, fifth legs. (From W. M. Wheeler)

Distribution.—Gulf of St. Lawrence, Puget Sound (Thompson and Scott); North Sea (van Breemen); off Nova Scotia (Wright); off Prince Edward Island and New Brunswick (Willey); Gulf of Maine (Bigelow); Woods Hole (Wheeler, Fish).

Color.—Body rather opaque and colorless except along the midline of the ventral surface, where in the female there are spots of reddish brown, in the male of black pigment. There is also in the male a spot of the same black above the intestine in the fifth segment. The hand of the chela in the fifth legs has a faint wash of reddish brown; the last two abdominal segments are covered with minute spots of bright reddish brown, which extend onto the caudal rami and become continuous there, covering the whole dorsal surface.

Female.—Posterior corners of fifth segment with processes curving outward and downward; genital segment only slightly swollen; anal segment asymmetrical and fused with the caudal rami, right ramus twice as wide as left, its outer seta replaced by a broad and flattened spine; end segment of fifth legs three or four times as long as penultimate segment, curved inward, tapered to an acute point, with both margins smooth and unarmed. Total length, 2–2.25 mm.

Male.—Body more slender; fourth and fifth segments separated with rounded posterior corners, without processes; urosome 5-segmented, turned to the right and twisted on its longitudinal axis; genital segment with a rounded process at the left distal corner; first abdominal segment with a pointed process at the right distal corner; right caudal ramus larger than the left and constricted near its base; end segment of left fifth leg no longer than penultimate segment; thumb on chela of right leg conical, blunt, and tipped with a short spine. Total length, 1.75–2 mm.

Remarks.—Wheeler described this as a new species under the name *Corynura bumpusii*, but it is evidently identical with the above species. It can be recognized by the peculiar asymmetry of the urosome in both sexes. It is a summer species and is practically confined to the shallower waters along shore, and is nowhere found in any numbers.

TORTANUS SETACAUDATUS Williams

FIGURE 115

Tortanus setacaudatus WILLIAMS, Amer. Nat., vol. 40, p. 649, figs. 12–15, 1906.

Occurrence.—Both sexes, surface tow, Waquoit Bay, Falmouth, July, 1925, a second lot at the same place, August, 1926; a third lot from small pond at the head of the bay, August, 1926.

Distribution.—Narragansett Bay in winter (Williams).

Color.—Body transparent, often tinged with blue around the mouth and the bases of the mouth parts on the ventral surface. A blue spot in the center of the last two segments of the metasome; eye dark blue.

Female.—Body short, stout and symmetrical; fourth and fifth segments indistinctly separated and smoothly rounded at the corners; urosome half as long as metasome; maxillipeds exceptionally large and carried horizontally at right angles to the body axis; fifth legs consisting of a fused basal portion and 2-segmented rami, the segments of equal length, the distal one broadly rounded, armed with one apical spine, two at the inner distal corner, and one at the center of the outer margin, all about the same size. Total length, 1.25–1.4 mm.

Male.—Shorter and narrower than the female; fourth and fifth segments distinctly separated; urosome 5-segmented and nearly symmetrical, the right caudal ramus a trifle larger than the left, with a tuft of stiff bristles on the outer margin; end segment of left fifth leg twice as long as penultimate segment; thumb of chela on right leg club-shaped, with subterminal spine. Total length, 0.75–0.95 mm.

Remarks. — This species may be recognized by the prevailing symmetry of the body and by the details of the fifth legs. Williams found it abundant in Narragansett Bay and Charlestown Pond, and further search will probably reveal its presence in other ponds around Woods Hole beside the two mentioned above.

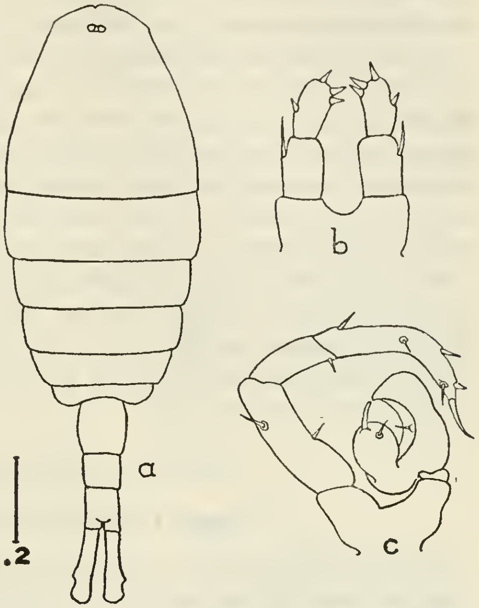

FIGURE 115.—*Tortanus setacaudatus*: *a*, Female, dorsal; *b*, female, fifth legs; *c*, male, fifth legs

Suborder HARPACTICOIDA

Fifth thoracic segment firmly attached to the sixth segment, but forming a movable articulation with the fourth segment. Posterior body usually about as wide as the anterior, and both divisions more or less cylindrical. Genital openings paired in both sexes, and on the ventral surface of the genital segment; one or two ovisacs. First antennae short, rarely more than 8- or 9-segmented, both prehensile in the male; second antennae biramose, the exopod 1- to 7-segmented. rarely obsolete; mandibles and first maxillae with a palp; second maxillae with digitiform processes; maxillipeds usually prehensile. First legs in the majority of cases more or less transformed into grasping organs, next three pairs natatory; fifth legs never natatory, but lamellar and usually 2-segmented, the basal segment enlarged on its inner margin into a broad expansion, both segments armed with plumose setae or spines, or both.

In this group, as in the Calanoida, the number of segments in the rami of the swimming legs is not always constant in all species of a given genus; they also sometimes differ in the two sexes of the same species. Hence it has been deemed advisable to include such genera and species twice in the key, and in several species the two sexes are necessarily separated. The same policy is followed in reference to the families as was adopted for the Calanoida.

The copepods in this group are very much smaller than the calanids, many of them only half a millimeter in total length, or even less. In consequence of this they are exceedingly difficult to dissect, and many authors are satisfied with a superficial examination of the species which they describe. As might be expected, this has resulted in a superabundance of synonyms, the majority of which are specific rather than generic. And in many instances the accurate data are not sufficient to determine the synonymy with any degree of satisfaction. An effort has been made in the key (Appendix B, p. 560) to treat the synonymy conservatively, but it is practically certain that future careful study and the discovery of additional data will change some of the names here adopted.

Family LONGIPEDIIDAE

Genus LONGIPEDIA Claus, 1863

Head fused with first segment, its lateral margins forming broad vertical lamellae inclosing the mouth parts; rostrum large and tongue-shaped. Epimeral plates of second, third, and fourth segments vertical, angularly produced at their posterior corners, and inclosing the bases of the swimming legs. Genital segment with a transverse dorsal median groove, and a sharp spine on each lateral margin just in front of the groove. Anal operculum with a terminal central spine and usually smaller ones on either side. First antennae stout, 5-segmented; exopod of second antennae 6-segmented. First legs smaller than succeeding pairs; second endopods greatly elongated; proximal segment of fifth legs with outer fingerlike process and narrow inner expansion, tipped with a single elongate curved seta; distal segment lamellar, with five setae and a terminal spine. One species found here.

LONGIPEDIA CORONATA Claus

FIGURE 116

Longipedia coronata CLAUS, Die frei lebenden Copepoden, p. 111, pl. 14, figs. 14–24, 1863.—SARS, Crustacea of Norway, vol. 5, p. 10, pls. 3, 4, 1903.

Occurrence.—A single female, Penzance Pond, July 9, 1925; two females, shore of Katama Bay, Marthas Vineyard, August 5, 1927.

Distribution.—Helgoland, Gulf of Naples (Claus); Norwegian fiords (Boeck, Sars); British seas (T. Scott); Suez Canal, Gulf of Manaar (Thompson and Scott); North Sea (Timm); Scottish coast

(Bourne); Shetland Islands (Norman); Boulogne (Canu); Narragansett Bay (Williams); Woods Hole Harbor (Fish).

Color.—Body yellowish gray, the cephalothorax and the sides of the metasome with a decided greenish tinge; caudal setae and the large spines on the elongated second legs dark cinnamon-brown; eye ruby red.

Female.—Metasome strongly compressed and of nearly uniform width, urosome tapering posteriorly; body segments with smooth posterior margins; caudal rami a little longer than wide, divergent, the apical setae spreading considerably. Rami of first four pairs of legs 3-segmented, spines on first exopod slender and elongate, the one on the second segment turned backward; distal segment of second endopods nearly three times as long as the first and second segments combined; distal segment of fifth legs with transverse rows of slender spinules on the anterior surface near its base. Total length, 1.2–1.3 mm.

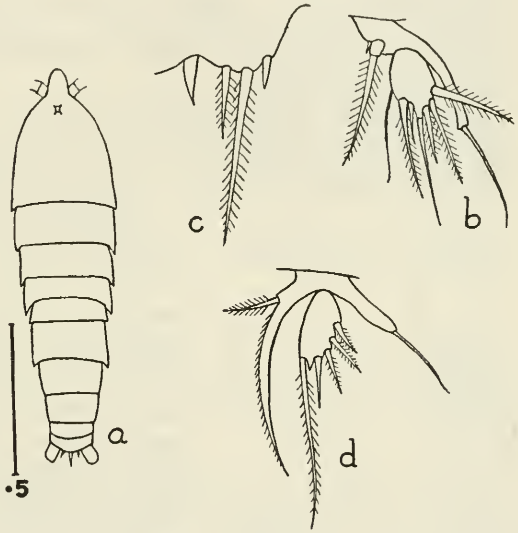

FIGURE 116.—*Longipedia coronata: a,* Female, dorsal (after Sars); *b, c,* male, fifth and sixth legs, respectively; *d,* female, fifth leg

Male.—Smaller than female, the urosome 5-segmented; first antennae terminating in a swollen, clawed hand; first four pairs of legs like those of female; distal segment of fifth legs armed with seven slender setae, without the terminal spine; inner expansion of basal segment with a single straight seta. Genital segment showing a rudimentary sixth pair of legs at its posterior corners, each made up of a small lamina armed with two setae and two spines. Total length, 1–1.1 mm.

Remarks.—This copepod can be recognized at once by the elongated second endopods and the peculiar form of the fifth legs. It sticks rather closely to the bottom, where the long second legs assist it in locomotion.

Genus CANUELLA T. Scott, 1893

Body nearly cylindrical; head separated from first segment; rostrum narrow and tongue-shaped; urosome of female 4-segmented, of male 5-segmented; caudal rami divergent and elongate, with apical setae of moderate length and a small seta near the center of the outer margin. Two ovisacs, somewhat divergent. First antennae 5-segmented, exopod of second antennae 7-segmented; first four pairs of legs with 3-segmented rami; fifth pair rudimentary, consisting of a narrow plate armed with setae. One species found here.

CANUELLA FURCIGERA G. O. Sars

FIGURE 117

Canuella furcigera SARS, Crustacea of Norway, vol. 5, p. 18, pl. 10, 1903.

Occurrence.—A single female was taken in Oyster Pond, Falmouth, July 20, 1926.

Distribution.—Norwegian fiords (Sars).

Color.—Body a uniform yellowish gray, the metasome with a few interrupted transverse bands of deeper orange-yellow; eye dark red.

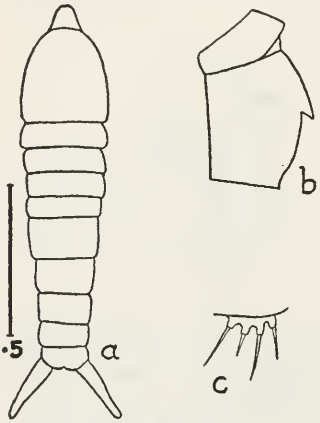

FIGURE 117.—*Canuella furcigera:* *a,* Female, dorsal (after Sars); *b,* female, genital segment, lateral; *c,* female, fifth leg

Female.—In addition to the generic characters given above, the female shows a distinct transverse groove across the middle of the dorsal surface of the genital segment. On the ventral surface just in front of this groove is a pair of small, juxtaposed, triangular lappets. Caudal rami as long as the three abdominal segments combined, each with a well-defined longitudinal carina on its dorsal surface; middle apical seta twice as long as the outer. Fifth legs narrow 4-lobed laminae, scarcely projecting from the surface of the fifth segment, each lobe tipped with a single seta, the outer and second inner ones longer than the others. Total length, 1.25–1.4 mm.

Male.—Similar to the female but smaller; genital segment without a transverse dorsal groove; the ventral lappets comparatively much larger than in the female, even reaching beyond the posterior margin of the genital segment, and fringed with setae. In the triangular space between them are two secondary lappets close together and smaller, each ending in a short spine; fifth legs similar to those of the female but smaller. Total length, 1.1–1.25 mm.

Remarks.—The dorsal carina on each caudal ramus and the ventral lappets on the genital segment are the most prominent characters. In the first legs of the female the setae on the two basal endopod segments are not fastened to the inner margin, but to the anterior surface, the one on the basal segment almost in the center of that surface, the one on the middle segment nearer the inner margin.

Family ECTINOSOMIDAE

Genus ECTINOSOMA Boeck, 1864

Body more or less spindle-shaped, the metasome scarcely wider than the urosome; head fused with the first segment and tapered anteriorly into a tongue-shaped rostral plate. Urosome 4-segmented in female, apparently 5-segmented in male, owning to the subdivision of the genital segment. In the female the genital segment is without any traces of subdivision, the anal segment is much shorter than those preceding it, and the caudal rami are short and somewhat divergent, the two apical setae close together and enlarged at their bases. First antennae small, 5- to 7-segmented; exopod of second antennae 3-segmented; first four pairs of legs with 3-segmented rami; fifth legs 2-segmented, distal segment 3-lobed, each lobe with a single seta, inner expansion of basal segment with two setae.

KEY TO THE SPECIES (BOTH SEXES)

1. Accessory seta of distal segment of fifth legs on lateral margin of segment, close to outer terminal seta__________________ normani (p. 173)
   Accessory seta of distal segment of fifth legs on anterior surface of segment near its base____ 2
2. Outer seta of distal segment of fifth legs much longer than inner; end setae of exopod of second antenna nearly equal__ elongatum (p. 175)
   Inner seta of distal segment of fifth legs longer than outer; end setae of exopod of second antenna very unequal______ curticorne (p. 174)

ECTINOSOMA NORMANI T. and A. Scott

FIGURE 118

Ectinosoma normani T. and A. SCOTT, Trans. Linn. Soc. London, ser. 2, vol. 6, pt. 5, p. 435, pl. 36, figs. 21, 29, 1896.—SARS, Crustacea of Norway, vol. 5, p. 35, pl. 19, fig. 2, 1904.

Occurrence.—Twenty-five males and females were obtained by Rathbun in Little Harbor, Woods Hole, September 6, 1881.

Distribution.—Firth of Forth (T. Scott); Ceylon (A. Scott); Vadsö, Finmark (T. Scott); Norwegian coast (Sars); Adriatic (Grandori, Pesta); Indian Ocean (Thompson and Scott); Chesapeake Bay (Wilson); Charlestown Pond, R. I. (Williams).

Color.—Body a uniform light gray, with a pair of conspicuous red patches on each side of the head between the bases of the two pairs of antennae.

Female.—Body spindle-shaped, with the greatest width in front of the middle; rostral plate short and blunt; caudal rami as wide as long and considerably divergent, the first inner apical seta only one-eighth as long as the third, the latter half the body length. Fifth legs with few surface spinules; the two apical setae of the distal segment and the two setae on the inner expansion of the basal segment very unequal, the outer one of the latter pair the shortest; accessory seta of the distal segment arising from the outer margin, inside and close to the base of the outer seta. Total length, 0.45–0.55 mm.

Male.—Considerably smaller than the female; genital segment distinctly divided into two nearly equal portions; first antennae prehensile, the third segment considerably enlarged, with a fingerlike process on its posterior margin; fifth legs similar to those of the female, but much smaller. Total length, 0.35 mm.

Remarks.—This species may be recognized by its minute size, and in living specimens by the bright red patches on the head. This is the first record at Woods Hole, but Williams found it in Charlestown Pond on the shore of Narragansett Bay.

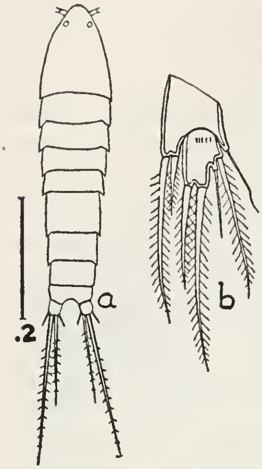

Figure 118.—*Ectinosoma normani: a,* Female, dorsal (after Sars); *b,* female, fifth leg

ECTINOSOMA CURTICORNE Boeck

Figure 119

Ectinosoma curticorne Boeck, Forh. Vid.-Selsk. Christiania, 1872, p. 45.—Sars, Crustacea of Norway, vol. 5, p. 36, pl. 20, fig. 1, 1904.

Occurrence.—Two females from Oyster Pond, Falmouth, July, 1896; two females from same pond, July, 1926.

Distribution.—Scottish coast (T. Scott); Norwegian coast (Sars); Spitzbergen, Franz Josef Land, Nova Zembla (T. Scott); mouth of Yana River, Siberia (Sars); North Sea (Timm); Jadebusen (Poppe); Chesapeake Bay (Wilson); Charlestown Pond (Williams); Woods Hole (Sharpe).

Color.—Body dark reddish brown, often inclined to yellow; a conspicuous dusky pigment spot just inside the base of each first antenna, near the lateral margin of the head.

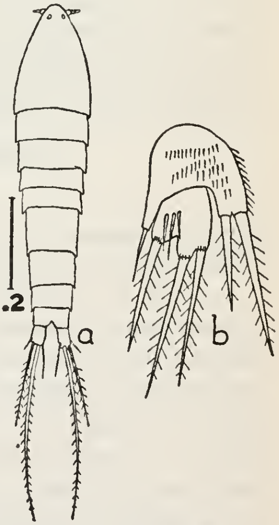

Figure 119.—*Ectinosoma curticorne: a,* Female, dorsal (after Sars); *b,* female, fifth leg

Female.—Body spindle-shaped, the greatest width in front of the middle; rostral plate short and blunt; fifth segment as wide as the fourth and the same width as the genital segment; caudal rami twice as long as wide and only slightly divergent, the first inner apical seta one-sixth as long as the second, which is half as long as the body. Fifth legs with several transverse rows of slender spinules across the surface of both segments; distal segment unequally trilobate, its setae elongate, with short plumes; three accessory setae arising from the posterior surface near the base of the segment, the middle one the longest. Total length, 0.6–0.75 mm.

Male.—Unknown.

Remarks.—This small species is evidently a northern form and widely distributed; it can be recognized most easily by the dark pigment marks near the bases of the first antennae.

ECTINOSOMA ELONGATUM G. O. Sars

FIGURE 120

Ectinosoma elongatum SARS, Crustacea of Norway, vol. 5, p. 32, pl. 18, fig. 1, 1904.

Occurrence.—Eight females were washed out of dredged sand from the sea bottom between Gay Head and No Mans Land, July, 1927.

Distribution.—Norwegian fiords (Sars).

Color.—Body a light yellow, more or less tinged with brown, but without any definite pigment markings.

Female.—Body elongate, the greatest width at the center; rostrum narrow, spoon-shaped, and nearly horizontal; caudal rami as long as anal segment, but seeming longer because the anal segment is deeply incised posteriorly. First antennae very slender, 6-segmented; exopod of second antenna reaching beyond the tip of the endopod. Fifth legs of medium size, the distal segment longer than wide and somewhat oblique, with a transverse row of spinules across its base, and just distal to these the accessory seta. The three setae at the tips of the lobes are very unequal, the inner one the shortest, the middle one three times as long, all minutely plumed. Inner expansion of basal segment narrow, reaching beyond the center of the distal segment, its inner apical seta the longer. Total length, 0.8–0.95 mm.

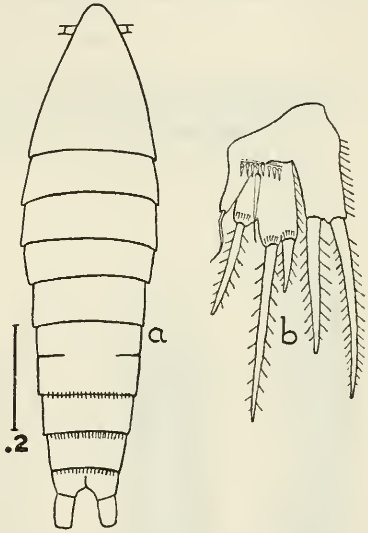

FIGURE 120.—*Ectinosoma elongatum:* *a*, Female, dorsal; *b*, female, fifth leg

Male.—Unknown.

Remarks.—This is the first record of the species outside of the locality where Sars obtained it. It can be most easily recognized by the form of the fifth legs, and is evidently a bottom species, living in the sand at moderate depths.

Genus MICROSETELLA Brady and Robertson, 1873

Body slender and compressed laterally; urosome as wide as metasome; head fused with first segment; urosome 4-segmented in female, apparently 6-segmented in male, the genital segment being completely divided. First antennae slender, elongate, geniculate in male, with two elongate aesthetasks; exopod of second antennae 3-segmented; first four pairs of legs with 3-segmented rami; fifth legs 2-segmented, distal segment imperfectly trilobate, with 3 setae, inner expansion of basal segment with 2 setae.

KEY TO THE SPECIES (BOTH SEXES)

1. Caudal setae shorter than body; setae on inner expansion of basal segment of fifth legs very unequal in length_____ **norvegica** (p. 176)
Caudal setae nearly twice as long as body; setae on inner expansion of basal segment of fifth legs equal in length________ **rosea** (p. 177)

MICROSETELLA NORVEGICA (Boeck)

FIGURE 121

Setella norvegica BOECK, Forh. Vid.-Selsk Christiania, p. 281, 1864.
Microsetella norvegica SARS, Crustacea of Norway, vol. 5, p. 44, pl. 24,[7a] 1904.

Occurrence.—Ten females from surface tow in Vineyard Sound.

Distribution.—British Isles (Brady); Atlantic Ocean (Brady and Robertson); Arctic Ocean Mrázek); Mediterranean (Car, Steuer, Grandori, Pesta); tropical Pacific (A. Scott); Red Sea, Indian Ocean (Thompson and Scott); Narragansett Bay (Williams).

Color.—Body yellowish white and transparent, without pigment markings.

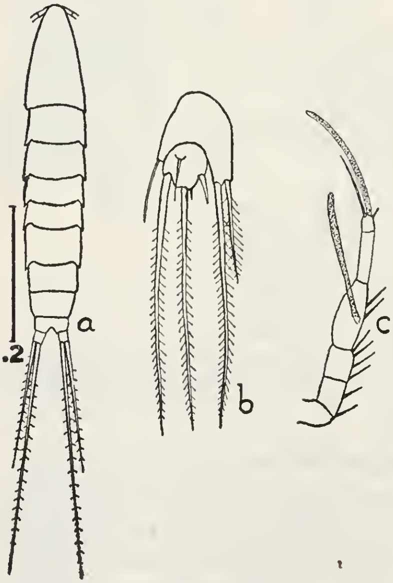

FIGURE 121.—*Microsetella norvegica: a,* Female, dorsal (after Sars); *b,* female, fifth leg; *c,* male, first antenna

Female.—Body almost linear and strongly compressed; head flattened dorsally; rostrum short and turned abruptly downward; segments of urosome with transverse rows of minute spinules; caudal rami about as wide as long, divergent, the second inner apical seta three-fourths as long as the body. Inner expansion of basal seg-

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[7a] This plate bears the label *Microsetella atlantica* and was not changed to agree with the text.

ment of fifth leg reaching tip of distal segment, its outer seta twice the length of the inner one; inner seta of distal segment one-eighth as long as the other two, which are about equal. Total length, 0.4–0.5 mm.

Male.—Smaller than female; genital segment completely divided at the center; caudal rami a little wider than long; first antennae geniculate, the distal portion made up of the last two segments; fifth legs like those of the female. Total length, 0.3–0.4 mm.

Remarks.—This minute species is common throughout the entire Atlantic; it may be distinguished by its minute size and the fact that the body is laterally compressed and usually lies upon its side.

MICROSETELLA ROSEA (Dana)

Figure 122

Canthocamptus roseus Dana, United States Exploring Expedition, 1838–1842 (Wilkes), vol. 14, Crustacea, p. 1189, 1853, pl. 83, fig. 10, 1855.

Microsetella rosea Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, p. 554, pl. 44, 1892.

Occurrence.—Ten females taken in surface tow in Woods Hole Harbor, July, 1926.

Distribution.—Sulu Sea (Dana); Naples (Giesbrecht); English seas (Brady); Woods Hole Harbor (Fish).

Color.—Body transparent, with a decided rosy or reddish tinge, which is deepest anteriorly and gradually fades away posteriorly.

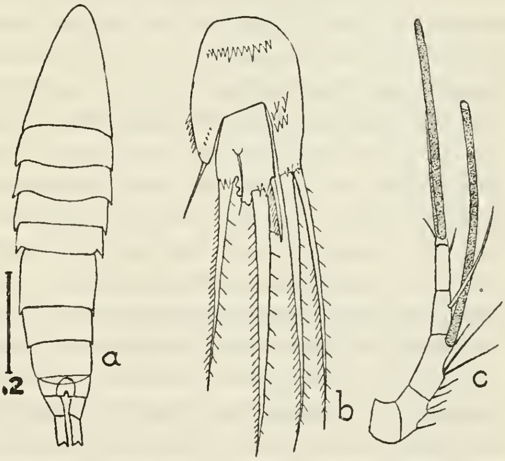

Figure 122.—*Microsetella rosea: a,* Female, dorsal (after Giesbrecht); *b,* female, fifth leg; *c,* female, first antenna

Female.—Body as strongly compressed as in the preceding species and nearly twice the size; second, third, and fourth metasome segments and the three abdominal segments with tranverse rows of spinules near the anterior margins; second inner apical seta of each caudal ramus nearly twice the body length. Inner expansion of basal segment of fifth legs reaching the tip of the distal segment, its apical setae about equal in length, its outer process very plump with two rows of small spinules running longitudinally; distal segment with an accessory seta on the posterior surface near the center. Total length, 0.65–0.85 mm.

Male.—Unknown.

Remarks.—This species can be recognized by the combination of rosy color, strong lateral compression, and elongate caudal setae. It is apparently a surface species and has thus far been taken only in surface tows.

ARENOSETELLA, new genus

Body slender and slightly compressed laterally; metasome scarcely wider than urosome; head fused with first segment; rostrum short and deflexed; sides of cephalothorax turned downward, partly covering the mouth parts and the bases of the swimming legs; genital segment not divided; urosome 4-segmented in female, 5-segmented in male, the anal segment armed on the dorsal surface with a pair of small curved claws, arranged like the jaws of a pair of pliers and working horizontally; caudal rami short, their inner apical setae elongate.

First antenna 5- or 6-segmented, slender, with a terminal aesthetask as long as the entire antenna; exopod of second antennae 3-segmented, the end segment the longest; mandibles with a very large palp, its distal segment spatulate, somewhat bifid at the tip, and armed with exceptionally long setae, its outer ramus rudimentary and destitute of setae. First maxillae simple, with a 2-lobed setiferous palp; second maxillae very large and tipped with seven long setae, three of which are denticulate; maxillipeds stout, with two terminal claws and two accessory spines. First four pairs of legs with 3-segmented rami, the endopods longer than the exopods; fifth legs 2-segmented, the inner expansion of the basal segment with two setae, the distal segment 3-lobed, with three setae. A single ovisac.

Genotype.—*Arenosetella spinicauda*, new species.

Remarks.—This genus is closely related to *Microsetella* but differs enough in its anatomical details to warrant generic distinction. The two pairs of antennae, the mouth parts, especially the maxillipeds, and the dorsal claws on the anal segment of the abdomen are distinguishing characters. Furthermore, both the known species of *Microsetella* are pelagic in their habits, being always found at or near the surface. In marked contrast the present genus actually lives within the bottom sand and seldom comes out to swim about freely. Its powers of locomotion are practically confined to crawling about in the sand, and its motion when swimming is sinuous and wormlike, rather than the jerky progress characteristic of most copepods.

KEY TO THE SPECIES (BOTH SEXES)

1. Claws on dorsal surface of anal segment simple, separated at base, and without accessory spines____________________ spinicauda (p. 179)
   Claws on dorsal surface of anal segment bifid, fused at base, and each armed with an accessory spine____________________ fissilis (p. 180)

ARENOSETELLA SPINICAUDA, new species

PLATE 2, *a–l*

Occurrence.—Fifty specimens, including both sexes, were washed out of the sand on the Buzzards Bay bathing beach at Woods Hole (male holotype, U.S.N.M. No. 63421); 10 females were washed out of the sand on the shore of Cape Cod Bay at the Dennis bathing beach; 2 females washed from the shore sands of Katama Bay, Marthas Vineyard.

Color.—Body transparent and colorless, without pigment markings.

Female.—Body seven and one-half times as long as wide, slightly tapered posteriorly; cephalothorax as long as the second and third thoracic segments combined, scarcely narrowed anteriorly and not vaulted dorsally; urosome more than half the length of the metasome, without spinules. Genital segment not divided, considerably longer than the first abdominal segment; anal segment short, twice as wide as long, with a pair of claws on its dorsal surface, close together, one on either side of the midline near the posterior margin of the segment. The bases of the claws are separated by a short space, are articulated to the surface of the segment, and the claws curve backward over the caudal rami, just reaching the tips of the latter. The caudal rami are as wide as long and quadrangular, the inner apical seta longer than the urosome, the next seta half as long, and both of these setae jointed near the base.

The first antennae are very slender, and, if we include the terminal aesthetask, are longer than the cephalic segment. The basal segment is slightly enlarged and the rest of the antenna is turned outward at an angle with it; the second and third segments are setose on the anterior margin, the other segments only sparsely so; the second segment carries an aesthetask, which reaches beyond the tip of the antenna, and the end segment is tipped with another aesthetask, as stout as the segment itself and as long as the whole antenna.

The second antennae are exceptionally large and curl up over the dorsal surface of the head; the endopod is 3-segmented, the middle segment a little longer than either of the others, the terminal segment spatulate, with a pectinated spine on the inner margin, 4 stout terminal spines, and a minute spinule on the outer margin. The inner terminal spine is twice the diameter of the others and is jointed near the middle; all four of these spines are sparsely pectinated. The exopod is 3-segmented, the end segment as long as the two basal segments combined and tipped with two unequal setae, with three short hairlike setae in a transverse row across the center of the segment.

The rami of the first four pairs of legs are very slender, the exopods reaching the tip of the middle segment of the endopods and fringed with small spines on their outer margins. The terminal segment of the fifth legs reaches for more than half its length beyond the tip of the inner expansion of the basal segment; it is imperfectly 3-lobed at the tip and armed with three long setae, of which the middle one is much the shortest; the inner expansion of the basal segment is narrow, squarely truncated, and tipped with two very unequal setae. Total length, 0.3–0.4 mm.

Male.—Body a little shorter than that of the female; cephalic segment quadrangular, as wide anteriorly as posteriorly; genital segment no longer than the first abdominal segment; dorsal claws of anal segment enlarged at the base and strongly curved. First antennae stouter than in the female, the aesthetask on the third segment widened and flattened and irregularly bent; second segment densely setose on its anterior margin and sharply bent. Fifth legs like those of the female but a little smaller. Total length, 0.28–0.35 mm.

Remarks.—This species may be distinguished by the presence of the two dorsal claws on the anal segment and by the long and slender first antennae. It appears to live within the sand, for it can only be obtained by digging up the sand to the depth of an inch or more and washing it thoroughly. Further examination will probably reveal its presence in the sands of many of the other beaches within the present area.

ARENOSETELLA FISSILIS, new species

PLATE 2, *m–p*

Occurrence.—Four females were washed from the beach sands of the Buzzards Bay bathing beach at Woods Hole in August, 1927. The female holotype is U.S.N.M. No. 63422.

Color.—Body transparent and colorless, without pigment markings.

Female.—Body of the same general shape as in the preceding species, but eight times as long as wide, and not tapered so much posteriorly; cephalothorax one-third longer than the second and third segments combined, projecting in rounded knobs at the anterior corners outside the bases of the first antennae; rostrum long, narrow, and tongue-shaped, carried horizontally and projecting beyond the middle of the second antennal segment. Fourth metasome segment a little longer than the third, and much longer than the fifth; urosome two-thirds as long as the metasome; genital segment undivided and one-half longer than the basal abdominal segment; anal segment a little less than twice as wide as long, its dorsal claws very different from those of *spinicauda*. The bases of the two claws are completely fused on the midline, and not so evidently articulated with the dorsal surface of the segment. Each claw is swollen basally and narrowed distally; the basal portion is armed with a slender spine on the dorsal surface nearer the outer margin; the slender terminal portion is split for its entire length into two strongly curved rami, whose tips reach beyond the ends of the caudal rami. The specific name *fissilis* (split) alludes to this division of the terminal portion of the claws. Both of the end setae of each caudal ramus are jointed near the base, and the inner one is more than half as long as the entire body. The basal segments of the first antennae are stout and the second segment is more like that of the male in *spinicauda*, densely setose along its anterior margin. In the second antennae the exopod is very slender and is tipped with two small subequal setae; the endopod is also quite slender, its end segment has two smooth spines on its inner margin, and five at the tip, no one of which is either enlarged or jointed. The swimming legs are similar to those of the preceding species, but the exopods do not have the fringe of spines along their outer margins; the fifth legs are a little smaller but no different in pattern, except that the middle apical seta of the distal segment is proportionally longer.

Total length, 0.35–0.45 mm.

Male.—Unknown.

Remarks.—This species is a little larger than *spinicauda* and can be distinguished at once by the split claws on the dorsal surface of the anal segment. It is not so common as the preceding species and was found only in the single locality recorded above. The dorsal claws are relatively much larger and must render efficient service as prehensile organs.

Family HARPACTICIDAE

Genus HARPACTICUS Milne Edwards, 1838

Body either compressed or somewhat depressed, and tapered posteriorly; head fused with first segment; rostrum curved downward and bluntly rounded; urosome 4-segmented in female, 5-segmented in male; caudal rami short and divergent, one of the terminal setae considerably elongated; a single ovisac. First antennae 8- or 9-segmented, geniculate in the male, the last segment of the proximal portion swollen and forming the hand of a chela, whose dactylus is the terminal portion of the antenna; exopod of second antennae 2-segmented; first legs with a 2-segmented exopod and a 3-segmented endopod; rami of second, third, and fourth legs 3-segmented, second endopod modified in male; fifth legs 2-segmented, well developed in female, the basal segment rudimentary in male.

KEY TO THE SPECIES

FEMALES

1. Basal segment of first endopod shorter than basal segment of exopod; distal segment of fifth legs twice as long as wide---------- 2
   Basal segment of first endopod as long as basal segment of exopod or longer; distal segment of fifth legs only one-half longer than wide---------- 3
2. Hand of maxilliped chela twice as long as wide, with a large spiniform process on its palmar margin at distal end---- **tenellus** (p. 182)
   Hand of maxilliped chela little longer than wide, without a spiniform process---------- **gracilis** (p. 183)
3. Body strongly compressed, more than four times as long as wide; inner expansion of basal segment of fifth legs with 3 setae---------- **chelifer** (p. 185)
   Body somewhat depressed, less than three times as long as wide; inner expansion of basal segment of fifth legs with 4 setae---------- **uniremis** (p. 186)

MALES

1. Exopod of third legs much enlarged and considerably longer than endopod, with elongated, coarse spines---------- 2
   Exopod of third legs little enlarged, and no longer than endopod, with relatively short, slender spines---------- 3
2. Body strongly compressed, fourth segment scarcely wider than fifth, with inconspicuous epimeral plates---------- **chelifer** (p. 185)
   Body somewhat depressed, fourth segment one-half wider than fifth, with prominent pointed epimeral plates---------- **uniremis** (p. 186)
3. Basal segment of second endopod four times as long as wide; hand of maxilliped chela with a spiniform process------ **tenellus** (p. 182)
   Basal segment of second endopod twice as long as wide; hand of maxilliped chela without a process---------- **gracilis** (p. 183)

HARPACTICUS TENELLUS G. O. Sars

FIGURE 123

Harpacticus tenellus SARS, Crustacea of Norway, vol. 7, p. 49, pl. 30, 1920.

Occurrence.—Twenty males and females found among algae in the Eel Pond at Woods Hole, June, 1925; three females from among algae in Katama Bay, Marthas Vineyard, July, 1925.

Distribution.—Norwegian coast (Sars).

Color.—Body quite transparent, of a uniform whitish gray, slightly washed with olive-brown along the grooves between the segments, but without definite pigment markings; eye dark ruby red.

Female.—Body somewhat depressed, the epimeral plates of the metasome segments very inconspicuous; fifth segment nearly as wide as the fourth; urosome segments with smooth posterior margins; caudal rami quadrangular, wider than long. First antennae 9-segmented, the terminal portion (five distal segments) scarcely longer than the fourth segment; hand of maxilliped chela twice as long as wide, with a large spiniform process on its inner margin near the base of the dactylus. Exopod of first leg slender and tipped with three subequal denticulate claws and a slender seta; inner seta of basal expansion of fifth legs much shorter than the others. Total length, 0.5–0.65 mm.

Male.—A little larger than the female with a narrower urosome; hand of chela on first antenna much longer than wide and only moderately swollen, the dactylus simple. Exopod of third legs widened a little but not lengthened, the basal segment scarcely longer than the second segment, the distal segment with four long and rather slender spines. The spiniform process of the maxilliped chela is slender and more sharply pointed than in the female. The fifth legs are reduced in size but the inner apical seta of the distal segment is as large as the outer, while the basal segment is very small and not at all expanded on the inside, and without setae. Total length, 0.55–0.7 mm.

Remarks.—This species can be told by the spiniform process on the hand of the maxilliped chela, and by the fact that the endopod of the first legs only reaches the tip of the basal segment of the exopod. It has never before been reported from American waters.

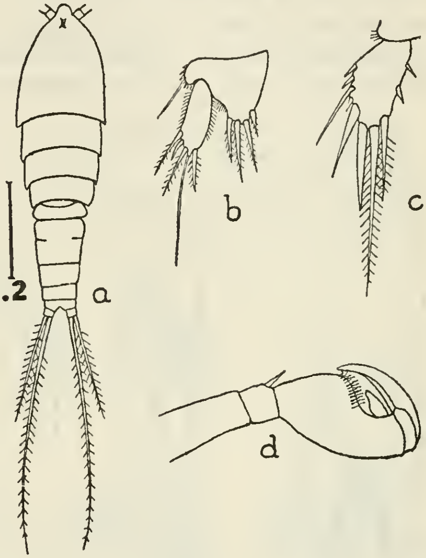

FIGURE 123.—*Harpacticus tenellus: a,* Female, dorsal (after Sars); *b,* female, fifth leg; *c,* male, fifth leg; *d,* male, maxilliped

HARPACTICUS GRACILIS Claus

FIGURE 124

Harpacticus gracilis CLAUS, Die frei lebenden Copepoden, p. 135, pl. 19, 1863.—SARS, Crustacea of Norway, vol. 5, p. 52, pl. 30, fig. 1, 1904.

Occurrence.—Both sexes obtained in considerable abundance in the Eel Pond, Woods Hole; in two of the brackish ponds on Chappaquiddick Island; Penzance Pond, Woods Hole; Oak Bluffs Pond, Sengekontacket Pond, and Nashaquitsa Pond, Marthas Vineyard; Great Pond and Waquoit Bay, Falmouth; French Watering Place on Naushon Island; Quissett Pond, Falmouth.

Distribution.—British Isles (Boeck, Brady); Kiel Bay (Giesbrecht); Mediterranean (Claus); Norwegian coast (Sars); Adriatic (Grandori, Pesta); Gulf of Genoa (Brian).

Color.—Body semitransparent, washed with a faint tinge of creamy yellow, and with transverse bands of reddish brown on the dorsal surface arranged as follows: One over the mouth shorter than the others; one on the first and one on the second thoracic segment, reaching almost to the lateral margins; one on each side of the fifth segment but not meeting on the midline; much wider bands covering the posterior half of the first and second abdominal segments and extending entirely around the body; these bands are wider on the sides and narrow on the dorsal and ventral surfaces. On the ventral surface also the various appendages are outlined in light brown and the grooves behind the first and second legs are dark reddish brown. The eggs are creamy yellow, with reddish centers; no eye is visible.

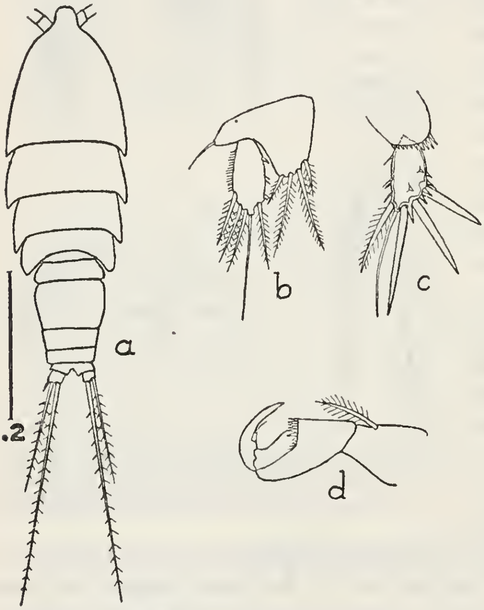

FIGURE 124.—*Harpacticus gracilis: a*, Female, dorsal (after Sars); *b*, female, fifth leg; *c*, male, fifth leg; *d*, male, maxilliped

Female.—Body somewhat depressed, the epimeral plates of the metasome rather prominent and angular at their posterior corners; fifth segment much narrower than the fourth; caudal rami considerably wider than long; urosome segments with smooth posterior margins. First antennae 9-segmented, the distal portion (last 5 segments) about one-third as long as the proximal part; hand of maxilliped chela stout and without a spiniform process; exopod of first legs tipped with three subequal denticulate claws, with a long slender seta at the inner corner, and a much shorter one at the outer corner. Inner expansion of basal segment of fifth legs with four denticulate setae, the inner one not reduced in size, distal segment oblong, its outer margin with a continuous fringe of cilia, its inner margin with scattered hairs. Total length, 0.5–0.66 mm.

Male.—Slightly larger than the female; hand of chela on first antennae ovoid, only moderately swollen, with a simple dactylus. Exopod of third leg curved strongly inward, its basal segment a little longer than the second segment, the distal segment oblique at its tip, its spines wide, but relatively very short, the seta at the inner distal corner elongated and plumose. Fifth legs very small, distal segment club-shaped, the three outer setae spiniform; basal segment without inner expansion. Total length, 0.55–0.7 mm.

Remarks.—When alive, and even after preservation in formalin, this species can be recognized by the transverse bands of reddish brown on the dorsal surface. It has not been reported before from our Atlantic coast. Found in fresh, brackish, and salt water.

HARPACTICUS CHELIFER (Müller)

FIGURE 125

Cyclops chelifer MÜLLER, Zoologiae Danicae prodromus, no. 2413, 1776.
Harpacticus chelifer SARS, Crustacea of Norway, vol. 5, p. 49, pls. 27, 28, 1904.

Occurrence.—At Little Harbor, Woods Hole, amid the eelgrass, September, 1881; in limited numbers in Penzance Pond, Woods Hole; Green Pond, Falmouth; two of the brackish-water ponds on Chappaquiddick Island; Nashaquitsa Pond and Farm Pond, Marthas Vineyard; French Watering Place, Naushon Island; in surface tow at Menemsha Bight, Marthas Vineyard.

Distribution.—British Isles (Brady); Kamchatka (Poppe); North Sea (Timm); coast of France (Canu); Franz Josef Land (T. Scott); Ceylon (A. Scott); Helgoland (Claus); Mediterranean (Giesbrecht, Pesta); Bohuslän (Cleve); Arctic Ocean (Mrázek); Indian Ocean (Thompson and Scott); New Zealand (Thomson); Jan Mayen (Koelbel); Nova Scotia (Wright); Gulf of St. Lawrence (A. Scott); Chesapeake Bay (Wilson); Charlestown Pond, R. I. (Williams); Woods Hole (Sharpe, Fish).

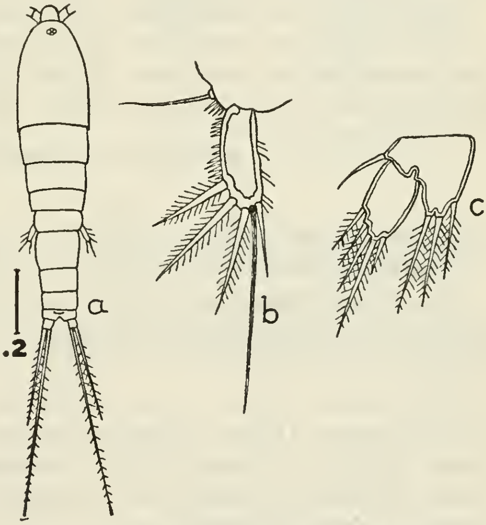

FIGURE 125.—*Harpacticus chelifer: a,* Female, dorsal (after Sars); *b,* male, fifth leg; *c,* female, fifth leg

Color.—Body a light yellow, fairly opaque, without pigment markings.

Female.—Cephalothorax large and deep, with a conspicuous rostrum; epimeral plates of the following segments rounded and closely appressed to the sides of the metasome; urosome less than half the length of the metasome; caudal rami longer than wide. First antennae 8-segmented; chela of maxillipeds very powerful and almost spherical, armed with coarse spines. Exopod of first legs tipped with three subequal pectinate claws, with no spines or setae; basal expansion of fifth legs with only three marginal setae; distal segment with five setae, the inner one very small. Total length, 0.75–1 mm.

Male.—Larger than the female, with a narrower urosome; chela of first antennae with an almost spherical hand and a simple dactylus. Exopod of third leg exceptionally large, its basal segment as long as the two distal segments combined, all three armed with long thick spines, and fringed with small teeth on their outer margins. Basal segment of fifth legs rudimentary, without an inner expansion; distal segment elongate, quadrangular, its inner apical seta short. Total length, 0.9–1.1 mm.

Remarks.—This species, like the preceding, is very well distributed through the present area. It may be recognized by its larger size, by the absence of the transverse dorsal bands and all other pigment markings, and by the swollen chela on the maxillipeds.

HARPACTICUS UNIREMIS Krøyer

FIGURE 126

Harpacticus uniremis KRØYER, Gaimard's voyage en Scandinavie, Atlas, pl. 43, fig. 1, *a–p*, 1845.—SARS, Crustacea of Norway, vol. 5, p. 51, pl. 29, 1904.

Occurrence.—Both sexes were obtained in large numbers from Quisset Pond, Falmouth, and Penzance Pond, Woods Hole, in July, 1925.

Distribution.—British Isles (Brady); Kiel Bay (Giesbrecht); Mediterranean (Claus); Norwegian coast (Sars, Krøyer); Arctic Ocean (Willey); Adriatic (Pesta, Grandori); Polar islands, Scottish coast (T. Scott); Bering Sea (Poppe); Gulf of Genoa (Brian); Narragansett Bay (Williams).

Color.—Body yellowish gray, showing a variable greenish tinge, with transverse bands of orange-yellow on the dorsal surface, not reaching the lateral margins; two bands on the cephalothorax, one band at each of the posterior margins of the second, third, and fourth metasome segments and the second and third abdominal segments, and a small spot on either side of the genital segment close to the lateral margin.

Female.—Body somewhat depressed, with the epimeral plates of the metasome expanded laterally, their posterior corners forming an acute angle; fifth segment but little narrower than the fourth; urosome segments with a fringe of coarse spinules on their posterior margins on the ventral surface; caudal rami wider than long, with convex margins. First antennae 9-segmented; exopod of first legs tipped with four small denticulate claws, increasing in length inwardly, and inside of these two or three slender naked setae. Inner expansion of basal segment of fifth leg with 4 thick setae and a transverse row of spinules on its anterior surface; distal segment rather pointed, its inner marginal spine large and stout. Total length, 1.1–1.25 mm.

Male.—Larger than the female; hand of chela on first antennae rather small and deeply lobed on its anterior margin, the dactylus hatchet shaped, with an accessory outer spine. Exopod of third legs nearly as strongly developed as in *chelifer*, but the basal segment is much shorter than the other two combined and the distal segment carries four spines instead of three. The inner apical seta of the distal segment of the fifth legs is as large as the others and plumose. Total length, 1.25–1.35 mm.

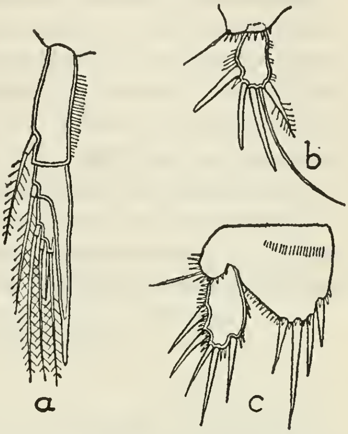

FIGURE 126.—*Harpacticus uniremis*: *a*, Male, second endopod; *b*, male, fifth leg; *c*, female, fifth leg

Remarks.—This is one of our largest harpactids, and can be told when alive by the transverse orange bands. Those on the abdomen are more persistent in preservatives and may be readily seen after the others have disappeared. Brian has given excellent figures of many development stages of this copepod in Studi del Laboratorio Marino Genova, 1921 (pp. 62–63).

ZAUSODES, new genus

Body much depressed, short and broad, the metasome much wider than the urosome, its segments expanded laterally into epimeral plates; fifth segment shorter than the fourth, but with well-developed plates; genital segment distinctly divided and somewhat widened, each half with epimeral plates; abdomen 3-segmented, segments very short and more or less telescoped; caudal rami wider than long, with short terminal setae. Rostrum broad and somewhat truncate at the tip; first antennae 8-segmented, the last four segments (terminal portion) very short in female, much longer and strongly prehensile in the male; second antennae well developed, the terminal segment tipped with geniculate setae, the exopod slender and 1-segmented; mandible with a large tripartite tooth at the outer corner, palp biramose; maxillipeds strong and of normal structure.

First legs with 2-segmented rami, both tipped with claws; the three succeeding pairs stout, with 3-segmented rami; fifth legs extended laterally, 2-segmented, the inner expansion of the basal segment narrow in the female, but fused across the midline in the male. A single ovisac, large and considerably flattened.

Genotype.—*Zausodes arenicolus*, new species.

Remarks.—This genus resembles in many particulars the one established by Goodsir in 1845 and called *Zaus*. But the fifth segment is only a little narrower than the fourth and carries well-developed epimeral plates, there is no trace of the dense ciliation on any of the appendages, and there are so many structural differences in the mouth parts, especially the maxillipeds, that it must be separated and established as a new genus. Only a single species has been found within the present area, but others will probably appear as the beach sands are more carefully examined.

ZAUSODES ARENICOLUS, new species

Plate 3

Occurrence.—About 200 specimens, including both sexes and development stages, were washed from the sand on the shore of Katama Bay, Marthas Vineyard, August 5, 1927 (male holotype, U.S.N.M. No. 63423). A few were also obtained from the sand of the southern beach of Marthas Vineyard, beneath the Atlantic surf.

Color.—Body semitransparent and without pigment markings; eggs bluish, sometimes inclined to brownish; no eye visible.

Female.—Metasome about the same width throughout, the lateral epimeral plates with sharp posterior corners; fifth segment a little reduced in length and width, its epimeral plates with bluntly rounded corners. Urosome one-third as long as metasome, its epimeral plates much reduced and inconspicuous; caudal rami as wide as long, their bases covered by the dorsal plate of the anal segment, their apical setae comparatively short, the inner one about twice the length of the outer; anal segment twice the length of the penultimate segment, with rounded posterior corners. Rostrum large, broadly rounded at the tip and well defined at the base. First antennae slender, the four basal segments fairly long, the four terminal ones very short, all well armed with setae, and the fourth segment carrying an aesthetask twice the length of the terminal portion of the antenna. Second antenna with its proximal segment distinctly divided and much longer than the distal segment; the latter is tipped with three long geniculate setae about equal in length, and has two or three small spines on its inner margin, and a small spine and a short seta on the outer margin. The exopod of this antenna is linear and 1-segmented, and is attached to the side of the proximal endopod segment some distance in front of where it is divided; it is tipped with two small subequal setae. The mandible has a stout masticatory blade armed with five small inner teeth and an elongated, 3-lobed tooth at the outer corner; the palp is biramose, the two rami some distance apart and of about equal length. The palp of the first maxilla is also biramose, the rami fused at their bases; the second maxilla has three digitiform processes inside the terminal claw. The maxillipeds are powerfully developed and are made up of two segments and a terminal claw; the basal segment has a tuft of hairs on each lateral margin and a seta near the distal end on the ventral surface; the second segment is the same length as the first, is slightly swollen through the center, and carries a small seta on the inner margin near the distal end; the terminal claw is slender and about as long as the second segment, without an accompanying bristle.

Both rami of the first legs are 2-segmented; the basal segment of the exopod has a spine and a fringe of short hairs on the outer margin, the distal segment is three times as long as the basal and enlarged at the tip, where it ends in three short claws of equal length, curved outward, and a smaller fourth one curved in the opposite direction. The basal segment of the endopod is four times as long as the distal segment; the latter is subspherical and tipped with two equal curved claws. The rami of the three following pairs of legs are 3-segmented, the two basal segments of the second and third exopods often fused, but distinctly indicated by the armature. The basal segment of the second endopod is without a seta, the middle segment has one and the terminal segment two on the inner margin. The basal segment of the third and fourth endopods has one inner seta, the middle segment has none, the end segment of the third leg has two inner setae, of the fourth leg only one seta. The spines of the exopods are perfectly smooth and show no trace of dentation, ciliation, or pectination; and the same is true of the terminal claws of the first legs. There is thus a complete absence of the brushlike or comblike series of cilia so characteristic of the genus *Zaus*.

In the fifth legs the inner expansion of the basal segment is comparatively narrow and does not reach the center of the distal segment; it has one terminal seta and two on the inner margin, the three some distance apart and the intervening margin fringed with spinules. The distal segment is twice as long as wide, considerably tapered distally, with a terminal seta and spine, two spines on the outer and one on the inner margin. Both segments are covered on the anterior (ventral) surface with rows of small spinules running in many directions. Total length, 0.4–0.6 mm.

Male.—Considerably smaller than the female but of similar form; fifth segment with even more prominent epimeral plates; genital segment divided, both halves and the two basal segments of the abdomen with small epimeral plates; caudal rami like those of the female. Rostrum shorter and wider and fringed with minute hairs; first antennae strongly prehensile, the fifth and sixth segments swollen into the hand of a chela, the dactylus being formed by the last two segments. In pairing the male extends these antennae their full length laterally and grasps the female on the dorsal surface in the groove between the cephalic and second segments with the claw of each chela.

The first legs are more slender than those of the female, and the exopod is not enlarged at the tip; the exopods of the third and fourth legs are armed with rows of small spinules on the anterior surface, but neither ramus shows any sex modification. In the fifth legs the basal expansions are much reduced in length but extend inward to the midline where the two are fused together; each is armed with two large setae widely separated; the distal segment has two terminal setae, three on the outer and one on the inner margin, all about equal in size. Total length, 0.25–0.35 mm.

Remarks.—This copepod was very abundant in the sand of Katama Bay; in spite of its depressed form it is very active, crawls about over the sand grains rapidly, and can swim with considerable agility. The ovisac is more than half the size of the body and extends far beyond the tips of the caudal setae.

Genus ZAUS Goodsir, 1845

Body short, broad, and rather strongly depressed; metasome much wider than urosome, its segments except the fifth expanded laterally into epimeral plates; anterior segments of urosome also expanded laterally; genital segment divided; urosome 4-segmented in female, 5-segmented in male; caudal rami short and lamellar. First antennae 9-segmented in female, 6-segmented and chelate in male; maxillipeds stout and strongly chelate. First exopod 2-segmented and much longer than the endopod; the latter and both rami of the three following pairs of legs 3-segmented. Fifth legs 2-segmented, the basal expansion short, but reaching the midline in the female, almost lacking in the male; distal segment large and more or less extended laterally beyond the body margin. Spines and claws of the antennae and swimming legs conspicuously ciliate, dentate, or pectinate. A single large ovisac. One species found here.

ZAUS GOODSIRI Brady

Figure 127

Zaus goodsiri Brady, A monograph of the free and semiparasitic Copepoda of the British Islands, vol. 2, p. 156, pl. 66, figs. 10–13, 1880.—Sars, Crustacea of Norway, vol. 5, p. 59, pl. 35, 1904.

Occurrence.—A male and a female were washed from the sands of the bathing beach at Dennis, on the north shore of Cape Cod, August, 1927.

Distribution.—British Isles (Brady); Helgoland (Claus); Arctic Ocean (T. Scott); Norwegian coast (Sars); Polar islands north of Grinnell Land (Sars).

Color.—Body dark yellow, with a broad reddish-brown transverse band across the thorax behind the head; eye deep red tinged with brown.

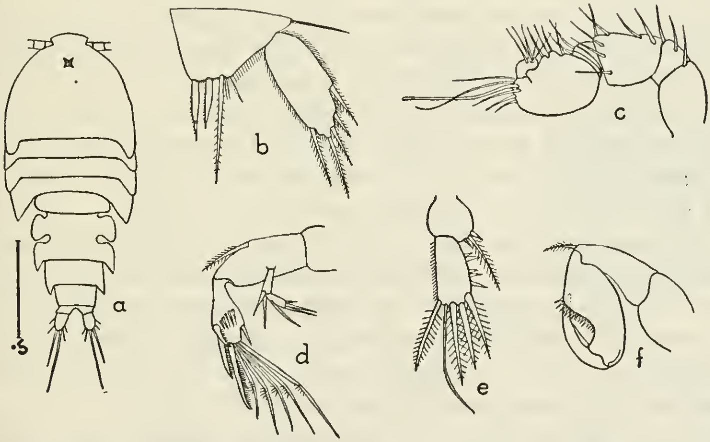

Figure 127.—*Zaus goodsiri: a,* Female, dorsal; *b,* female, fifth leg; *c,* male, first antenna; *d,* second antenna; *e,* fifth leg; *f,* maxilliped

Female.—Body much depressed, the integuments incrusted; cephalic segment broad and much longer than the free thorax; epimeral plates of the latter tongue-shaped; fifth segment much narrowed and without lateral plates. Urosome two-thirds as long as metasome; anal segment very short and deeply cleft; caudal rami twice as long as wide, with a small dentiform process at the outer distal corner; apical setae only half the length of the urosome. First antennae short and stout; exopod of second antennae 2-segmented, with five setae; spines of distal segment of endopod with a fringe of short cilia on the outer margin. Maxilliped strongly developed, the hand ovoid, more than twice as long as wide, the dactylus short and stout. Claws on the first legs and spines on all the exopods fringed with short cilia only, not fimbriated. Fifth legs very large, basal expansion lamellar, truncated at the tip, with four setae, the second outer one very long and slender, the two inner ones broad and spinelike; distal segment oblong-oval and densely hirsute, with five setae. Total length, 1.25–1.5 mm.

Male.—Smaller than the female, with the urosome 5-segmented; anal segment as long as the one preceding it and cleft nearly to its base; caudal rami a little longer than wide, with a dentiform process at the outer corner as in the female; terminal setae relatively longer. First antennae 6-segmented, third segment no longer than basal segment and as wide as long, fifth segment longer and wider than the third, end segment very short, strongly curved and swollen at its tip. The end segment of the second antenna has five slender geniculate setae and one long, stout spine at the apex, two spines on the inner and one on the outer margin, and a row of slender spinules across the dorsal surface; the spines are fringed with short cilia on their outer margins. The exopod is 2-segmented, the segments nearly at right angles to each other, the basal one with two setae, the terminal one with three setae and a minute spine. The hand of the maxilliped chela is twice as long as wide and is hollowed on its inner surface at the distal end, the margins of the hollow fringed with small spines.

The first legs are more slender than in the female, but otherwise of the same pattern, including a conspicuous break on the inner margin of the basal exopod segment near the distal end. The other swimming legs are like those of the female; the fifth legs have an elongate, distal segment, with five apical setae, the second inner one longer and more slender than the others; the outer margin is armed with scattered spines, the inner with a fringe of short hairs; the basal segment is armed outwardly with a seta and two short spines, and has no inner expansion. Total length, 0.75 mm.

Remarks.—The length of this male indicates that it was probably not fully grown, but even then it is much too large for other species of the genus. The details of the description here given will supplement the somewhat meager account given by Brady. The species has never before been reported from our American shores.

Family PELTIDIIDAE

Genus ALTEUTHA Baird, 1845

Body oval or elliptical in outline, the lateral margins of the head turned ventrally; metasome segments with lateral epimeral plates; urosome very short and broad and usually turned downward; genital segment subdivided, its halves and the abdominal segments also with epimeral plates; caudal rami short and broadly lamellar, each with a stout spine on the ventral surface in addition to the usual setae. First antennae 8 or 9 segmented, prehensile in the male.

Rami of first four pairs of legs 3-segmented; fifth legs uniramose, 2-segmented, distal segment sword-shaped, with stout spines at its tip. One species found here.

ALTEUTHA DEPRESSA Baird

FIGURE 128

Alteutha depressa BAIRD, Trans. Berwickshire Nat. Club, vol. 2, p. 155, 1845.—SARS, Crustacea of Norway, vol. 5, p. 64, pl. 38, 1904.

Occurrence.—Three females were obtained in a surface tow inside of Monomoy Island, Cape Cod, August, 1882.

Distribution.—British Isles (Brady, Baird); coast of France (Canu); Norwegian coast (Sars); Chesapeake Bay (Wilson); Sheepshead Bay, Woods Hole (Sharpe).

Color.—Body olive-yellow with a dark purple transverse band occupying the first three thoracic segments. The tips of the appendages are also frequently tinged with purple; the yellow portions are fairly transparent, but the dark band is nearly opaque; eye red tinged with purple.

Female.—Body strongly depressed, widest at about the center, head fused with first segment, the two longer than the rest of the metasome; posterior corners of fifth segment angular; eye considerably back of the anterior margin; urosome short and broad, each of its segments produced at its posterior corners into conical points; metasome segments with lateral epimeral plates; caudal rami quadrangular, slightly longer than wide, their terminal setae short and weak.

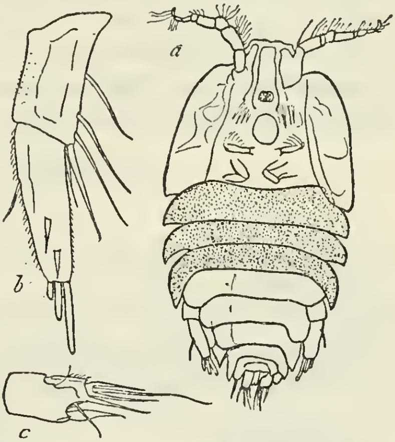

FIGURE 128.—*Alteutha depressa*: *a*, Male, ventral; *b*, female, fifth leg; *c*, female, caudal ramus. (From R. W. Sharpe, Proc. U. S. Nat. Mus., vol. 38, p. 416)

First antennae 9-segmented; exopod of second antennae 2-segmented, with 4 setae; endopod of first legs almost as long as exopod and much widened; fifth legs 2-segmented, proximal segment slightly enlarged, with five inner setae, distal segment conically tapered and tipped with three coarse spines. Total length, 1.2–1.4 mm.

Male.—Unknown.

Remarks.—This is a littoral rather than a pelagic species and is nowhere found in abundance. Sars gave it as preferring a sandy or gravelly bottom in comparatively shallow water. Sharpe was the first to record it from American shores, but the present specimens were collected 30 years before Sharpe's paper was published. Both he and Fish obtained the species off the Bureau of Fisheries wharf at Woods Hole, and Fish named it as one of the most common summer copepods of the region.

Family TEGASTIDAE

Genus PARATEGASTES G. O. Sars, 1904

Body short and compact, strongly compressed, with very hard integuments; head separated from first segment; fifth segment fused with genital segment and produced ventrally into a large process, highly chitinized; abdomen short. First antennae 7-segmented; exopod of second antenna 1-segmented; first legs with 1-segmented rami, second and third legs with 2-segmented rami, fourth legs with 3-segmented rami; fifth legs much enlarged and laminate in female, narrow and linear in male. Only one species found here.

PARATEGASTES SPHAERICUS (Claus)

FIGURE 129

Amymone sphaericus CLAUS, Die frei lebenden Copepoden, p. 114, pl. 20, figs. 1–9, 1863.

Parategastes sphaericus SARS, Crustacea of Norway, vol. 5, p. 73, pl. 43, 1904.

Occurrence.—Fifty specimens, including both sexes, from surface tow, Woods Hole harbor, September, 1881; one female from brackish pond on Chappaquiddick Island, August, 1926; one female washed from sand of Nobska Beach, Falmouth, August, 1927.

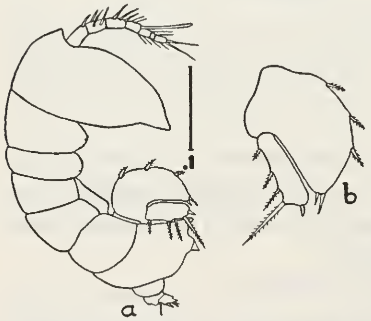

FIGURE 129.—*Parategastes sphaericus*: *a*, Female, lateral; *b*, female, fifth leg

Distribution.—Scottish coast (T. Scott); Helgoland (Claus); coast of France (Canu); Mediterranean (Claus); Ceylon (A. Scott); coast of Norway (Sars); Adriatic (Pesta); Narragansett Bay (Williams).

Color.—Body black, with a little light red coloring at the anterior margin of the head; toward the posterior end of the body the black fades into a neutral tint or translucent gray, which is apparently due to the legs coiled up beneath the body. The black color is absolutely opaque (Rathbun).

Female.—Lateral portions of head produced ventrally into large laminae, whose postero-lateral corners are obtusely acute; ventral dilation of genital segment quadrangular, its anterior corner tongue-shaped, its posterior corner curved backward like a claw, and between the two on either side a small recurved spine. Terminal segment of fourth endopod linear, without lateral setae, with two unequal terminal spines. Inner expansion of basal segment of fifth legs broad and vaulted, with two unequal terminal setae and three on the inner margin; distal segment linear, extending a little beyond the inner expansion, with a short terminal seta and four longer setae on the outer margin, the distal one elongated. Total length, 0.3–0.4 mm.

Male.—Smaller than the female, the postero-lateral corners of the head obliquely truncated; first antennae prehensile, the fourth segment considerably enlarged, the terminal segment clawlike; fifth legs linear and elongated, the basal segment without an inner expansion, the distal segment tipped with two unequal setae. Total length, 0.25–0.35 mm.

Remarks.—This minute harpactid was reported by Williams from Narragansett Bay, but has not hitherto appeared in any list of the Woods Hole region. It is easily recognized by its black color and its habit of rolling up its body into a ball.

Family TISBIDAE

Genus TISBE Lilljeborg, 1853

Body considerably depressed; head fused with the first segment, with angular posterior corners; second, third, and fourth segments with broad epimeral plates, obtuse at their tips; fifth segment greatly narrowed. Urosome sharply defined from metasome; genital segment divided by a dorsal groove across the middle; abdomen 3-segmented in female, 4-segmented in male; caudal rami short and broad. First antennae 8-segmented, geniculate in the male; exopod of second antennae 4-segmented; first four pairs of legs with 3-segmented rami, setae on the end segment of the first exopod penicillate at their tips; fifth legs slender, 2-segmented, the distal segment narrow linear.

Remarks.—The genus *Idya* was established by Philippi in 1843, and the genus *Tisbe* by Lilljeborg in 1853, the two being identical. But the name *Idya* had been preoccupied in 1809, and hence Lilljeborg's name becomes valid, and not the name *Idyaea* proposed by Sars in 1909.

KEY TO THE SPECIES (BOTH SEXES)

1. First antennae short, third and fourth segments each shorter than second; distal segment of fifth leg four times as long as wide -- **furcata** (p. 196)

   First antennae elongate, third and fourth segments each longer than second; distal segment of fifth leg six times as long as wide -- **longicornis** (p. 197)

   First antennae long and tapered; third and fourth segments combined shorter than second; distal segment of fifth leg twice as long as wide -- **wilsoni** (p. 198)

TISBE FURCATA (Baird)

Figures 130, 131*a*

Canthocamptus furcatus Baird, The natural history of the British Entomostraca, p. 210, pls. 25, 30, 1850.

Idyaea furcata Sars, Crustacea of Norway, vol. 5, p. 88, pls. 51, 52, fig. 1, 1905.

Occurrence.—Found in surface tows in Cuttyhunk Harbor; Penzance Pond, Woods Hole; Waquoit Bay, Falmouth; Sengekontacket and Nashaquitsa Ponds, Marthas Vineyard.

Distribution.—Atlantic Ocean, British Isles (Baird); Arctic Ocean, Kattegat, French coast (Canu); Mediterranean, Red Sea (Thompson and Scott); New Zealand (Thomson, Brady); Chatham Islands, Norwegian coast (Boeck, Sars); Franz Josef Land (T. Scott); North Sea (Timm); Madeira (Fischer); Greenland (Buchholz); Gulf of Genoa (Brian); Adriatic (Car, Graeffe, Pesta); Nova Zembla (Brady); Kiel Bay (Möbius, Giesbrecht); Alaska, Passamaquoddy Bay (Willey); Chesapeake Bay, Halifax, Nova Scotia (Wilson); Narragansett Bay (Williams); Woods Hole (Sharpe, Fish).

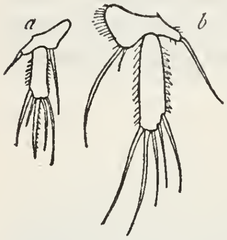

Figure 130.—*Tisbe furcata: a,* Male, fifth leg; *b,* female, fifth leg. (From R. W. Sharpe, Proc. U. S. Nat. Mus., vol. 38, p. 417)

Color.—Body transparent, with faint transverse bands of violet, the ovary and ovarian tubes blue, appearing dark bluish black by transmitted light, and showing distinctly through the integument; the long setae on the antennae and caudal rami violet; eye dark crimson (Rathbun).

Female.—Metasome elliptical, the width more than half the length; urosome half as long as the metasome and tapered posteriorly; caudal rami one-half wider than long, the second inner apical seta twice the length of the urosome. First antennae scarcely reaching the second metasome segment, their terminal portion 4-segmented; third and fourth segments of their basal portion each shorter than the second segment; distal segment of fifth legs four times as long as wide; outer process of basal segment long and slender. Total length, 0.8–1.2 mm.

Male.—Considerably smaller than the female, the urosome not so sharply separated from the metasome; genital segment not divided; first antennae geniculate, the terminal portion made up of two segments; fifth legs smaller, the distal segment little more than twice as long as wide, its middle apical seta transformed into a stout denticulated spine. Total length, 0.5–0.8 mm.

Remarks.—This is one of the most widely distributed harpactids and is often found in large numbers close to the shore, among algae.

Living specimens can be told by their large size and peculiar color, in preserved material the tufted cilia on the spines of the first exopods will locate the genus and a comparison of the fifth legs will determine the species.

TISBE LONGICORNIS (T. and A. Scott)

FIGURE 131*b*

Idya longicornis T. and A. SCOTT, Ann. Mag. Nat. Hist., ser. 6, vol. 15, p. 461. pl. 17, 1895.—SARS, Crustacea of Norway, vol. 5, p. 92, pl. 54, fig, 1, 1905.

Occurrence.—Three females were obtained in a surface tow along the edge of the eelgrass in Cuttyhunk Harbor, July, 1925.

Distribution.—Scottish coast (T. and A. Scott); Norwegian coast (Sars); Ceylon, Indian Ocean (Thompson and Scott); Adriatic (Grandori, Pesta).

Color.—Body transparent, with a slight tinge of blue; a band of dark violet across the posterior portion of the cephalic segment, and another across the anterior part of the abdomen; the bases of the legs show through the transparent thorax as transverse dark bands; eye dark red.

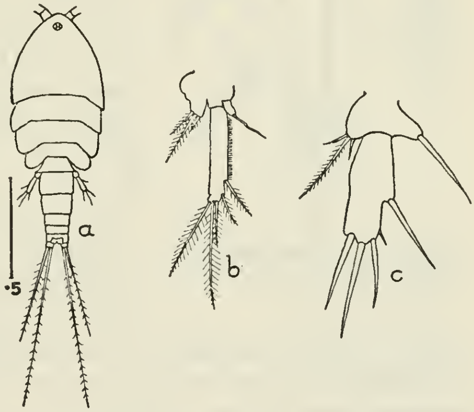

FIGURE 131.—*a*, *Tisbe furcata*, female, dorsal; *b*, *T. longicornis*, female, fifth leg; *c*, *T. wilsoni*, female, fifth leg (typical)

Female.—Body slender, the epimeral plates broader than in *furcata;* urosome narrow and only slightly tapered posteriorly; caudal rami wider than long, the second inner apical seta fully three-fourths as long as the entire body. First antennae reaching the third metasome segment, their third and fourth segments each longer than the second segment, the four terminal segments combined scarcely longer than the fourth segment. Distal segment of fifth leg at least six times as long as wide, with three unequal apical setae and two on the outer margin. Total length, 1.5–1.7 mm.

Male.—Unknown.

Remarks.—This species can be recognized by the length of the first antennae, especially the fourth antennal segment, and by the details of the fifth legs. It has never before been reported from our American coasts.

TISBE WILSONI Seiwell

FIGURES 131*c*, 132

Tisbe wilsoni SEIWELL, Proc. U. S. Nat. Mus. vol. 73, art. 18, p. 3, pl. 2, 1928.

Occurrence.—Both sexes were obtained from the common sea pork, *Amaroucium*, collected near Woods Hole in the summer of 1925.

Color.—Female creamy white and fairly transparent, ovaries and oviduct dark brown; male grayish white with a dark patch in the epimeral plate on either side of the first four thoracic segments.

Female.—Body slender, metasome oval, twice as long as wide, urosome less than half the length of the metasome; genital segment divided at the center; caudal rami longer than anal segment, apical setae half the body length. First antennae 8-segmented and strongly tapered, especially distally; exopod of second antennae 4-segmented, attached to side of basal segment of endopod. Endopod of first legs twice as long as exopod, second segment longer than first, end segment spherical, its two apical claws without plumes. Basal segment of fifth leg not much widened, its inner expansion with three setae; apical segment laminate, its width two-fifths of its length, with three end setae and two on the outer margin. Total length, 0.94 mm.

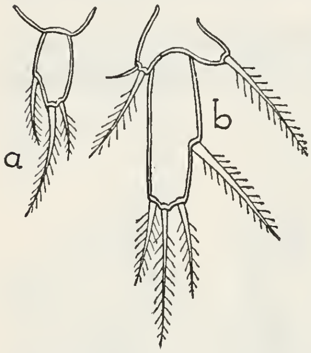

FIGURE 132.—*Tisbe wilsoni: a,* Male, fifth leg; *b,* female, fifth leg (variant)

Male.—Body much more slender and elongated than that of the female; urosome 5-segmented, the genital segment divided in front of its center, and slightly tapered backward, caudal rami as wide as long. First antennae geniculate, the terminal portion made up of two segments; second antennae, mouth parts, and first four pairs of legs as in the female. Fifth legs 2-segmented, basal segment without either inner expansion or outer process, terminal segment nearly as wide as long with two apical and one lateral setae. Total length, 0.7 mm.

Remarks.—This species is chiefly distinguished by the fact that it lives commensally in an ascidian. It conforms closely to the genus type except in the fifth legs of the male, which are considerably degenerated.

CHAPPAQUIDDICKA, new genus

Head fused with the first segment; metasome considerably depressed, the first 4 thoracic segments with broad epimeral plates, the fifth segment abruptly narrowed to half the width of the fourth and without lateral plates; urosome half as long and less than half as wide as metasome; genital segment not divided; abdomen 3-segmented in female, 4-segmented in male; caudal rami short and wide. First antennae slender, 8-segmented, geniculate in male; endopod of second antennae 3-segmented, exopod 2-segmented; mandibular palp biramose, maxillary palp only slightly lobular; second maxillae and maxillipeds both uncinate; endopod of first legs 2-segmented, exopod 3-segmented, both rami natatory and not prehensile; rami of second, third, and fourth legs 3-segmented; fifth legs 2-segmented, basal segment without an inner expansion, distal segment narrow-elongate. Two ovisacs, oviducts opening dorso-laterally.

Genotype.—Chappaquiddicka pulchella, new species.

CHAPPAQUIDDICKA PULCHELLA, new species

Plates 1*b*, 4

Occurrence.—Both sexes found in considerable abundance among the algae in two of the brackish ponds of Chappaquiddick Island, July, 1925. The male holotype is U.S.N.M. No. 63424.

Color.—Body transparent, tinged with faint yellow, a triangular spot behind the eye, an elongated triangular area on either side of the head pointing diagonally backward, and the anterior margins of the second, third, and fourth metasome segments vermilion-red. Narrow bands of the same color extend across the genital and abdominal segments. This color also extends around the posterior margins of the epimeral plates of the third and fourth thoracic segments and appears on the fronto-lateral margin of the head and on the anterior surface of the upper lip. Eye ruby red, the lenses colorless and sparkling like diamonds. Ovaries and oviducts bright bluish green; eggs also bluish green, in a single layer in each ovisac.

Female.—Metasome elongate-ovate, a little more than twice as long as wide, and strongly vaulted dorsally; head fused with the first segment and almost exactly half the length of the metasome; second and third segments the same width as the head, fourth segment slightly narrower, fifth segment abruptly reduced to half the width of the fourth. Urosome a little more than half the length of the metasome, the same width as the fifth metasome segment, only slightly tapered posteriorly. Genital segment as long as the three abdominal segments combined, with no signs of a division; abdomen 3-segmented, the segments diminishing slightly in length and width posteriorly; caudal rami half the length of the anal segment, as wide as long, each tipped with two long setae, the inner of which is as long as the urosome. First antennae reaching the center of the second thoracic segment, 8-segmented, the second, third, and fourth segments elongate and widened, the terminal portion (four end segments) no longer than the fourth segment. A long aesthetask, apparently jointed a little beyond its center, is attached to the fourth segment and extends far beyond the tip of the antenna. Endopod of second antenna 3-segmented, the three segments about equal in length, exopod 2-segmented and attached to the side of the basal endopod segment, its distal segment three times the length of the proximal. Mandibles peculiar, the masticatory blade armed outwardly with eight large curved teeth and inwardly with a long series of minute saw teeth, projecting in a broad lobe beyond the inner margin of the blade, the lobe tipped with a stout spine. Palp biramose, the exopod with two apical setae shorter than the endopod with four apical and one inner setae.

First maxilla and its palp each tipped with a tuft of stout spine-like setae; epipodal lobe lacking; second maxilla without any trace of the single lateral lobe found in *Tisbe*, the process on the inner margin of the second segment near the center spatulate and fringed with short hairs; the outer margin also bears a small hooked process beyond its center. In the maxilliped the third segment is distinctly separated, and the terminal claw is very slender and much longer than the second and third segments combined; the accessory spine is on the inside close to the base of the claw, and very short; the basal segment is fringed with short hairs on both lateral margins; the second segment has a similar fringe on the inner margin, with five hairlike setae at the proximal end and a single one near the distal end.

The segments of the rami of the swimming legs are all much widened and laminated; their plumose setae are very long and are jointed somewhere between the base and the center, the portion proximal to the joint being often wider than the terminal portion. The second, third, and fourth legs bear considerable resemblance to those of *Tisbe*, but the first pair are very different; the two basal exopod segments carry a smooth acuminate outer spine, the end segment has four apical setae, a short seta on the outer margin, and a very long one on the inner margin, and no spines; all the setae are jointed. The endopod is 2-segmented, and shorter than the exopod, its segments nearly as wide as long, the basal one armed with a very stout inner seta, not jointed, the end segment with four slender setae, all jointed. The basal segment of the fifth leg is only slightly expanded inside and armed there with one long seta and two very short ones; the distal segment is almost linear and expanded at the tip, where it carries five setae, the second inner one much shorter than the others. Total length, 1.1–1.2 mm. Greatest width, 0.35 mm.

Male.—Body similar to that of the female, but smaller and more slender; urosome less than half the length of the metasome, the abdomen with four segments. First antennae geniculate, the last four segments turned forward; aesthetask at the end of the fourth segment longer and larger than in the female. Second antennae, mouth parts, and swimming legs similar to those in the female; in the fifth legs the inner expansion of the basal segment is almost obsolete and carries but a single seta; the outer apical seta of the distal segment is elongated. There is also a sixth pair of legs on the ventral surface of the genital segment behind the genital tubercles; each is curved strongly outward and armed with four setae, the outer one of which is larger than the others and extends beyond the lateral margin of the segment. Total length, 0.7–0.8. Width, 0.2 mm.

Remarks.—This is one of the most beautiful and graceful copepods in the entire Woods Hole area, and it swims with all the ease and agility of a cyclopoid. It was found in company with many other harpactids and with *Cyclops varicans*, and in its habits is far more like the latter than like the former.

Family THALESTRIDAE

Genus THALESTRIS Claus, 1863

Body stout and more or less deflexed ventrally; head fused with first segment and laterally compressed, the epimeral portions turned downward and including between them the mouth parts; epimeral plates of second, third, and fourth segments thin and also turned downward; urosome 4-segmented in female, 5-segmented in male; genital segment only partially divided; caudal rami short and wide, their apical setae very unequal. First antennae 9-segmented; exopod of second antennae 2-segmented; rami of first four pairs of legs 3-segmented; middle segment of first exopod and basal segment of first endopod elongated; fifth legs large and foliaceous in the female, much smaller in the male. One species found here.

THALESTRIS GIBBA (Krøyer)

FIGURE 133

Harpacticus gibbus KRØYER, Gaimard's voyage en Scandinavie, Atlas, pl. 43, fig. 2, *a–p*, 1845.

Thalestris gibba SARS, Crustacea of Norway, vol. 5, p. 105, pl. 61, 1905.

Occurrence.—Taken in large numbers in a surface tow by V. N. Edwards in Woods Hole Harbor; about 500 males and females were obtained from boards under wharves at Fort Point, Gloucester, and are now in the United States National Museum collection, showing that it is even more numerous a little farther north.

Distribution.—Franz Josef Land (T. Scott); Norwegian and Finnish coasts (Sars, Krøyer); Woods Hole (Sharpe).

Color.—Entire body dark bluish black except the dorsal surface of the cephalothorax, which is light gray; eye reddish or sometimes bluish.

Female.—Rostral projection fairly prominent and angular at its tip; posterior margins of all the segments finely crenulated; genital segment wider than the fifth metasome segment, a median division indicated laterally; caudal rami nearly three times as long as wide, the inner apical seta stouter than the others and about twice the length of the rami. Exopod and endopod of first legs equal in length, with smooth apical claws; fifth legs broadly foliaceous, extending beyond the center of the genital segment, the inner expansion of the basal segment reaching the tip of the distal segment, with five apical setae; distal segment with three outer and three apical setae, the latter very slender. Total length, 1.4–1.6 mm.

Male.—Smaller than the female; first antennae stout and geniculate, the terminal portion very short and curved. Endopod of second legs with its second and third segments fused and armed with stout spines; fifth legs much smaller than those of the female, the inner expansion of the basal segment very short, with three unequal setae, the middle one elongate, the outer one minute; distal segment narrowed terminally, but carrying six setae. Total length, 1.25–1.4 mm.

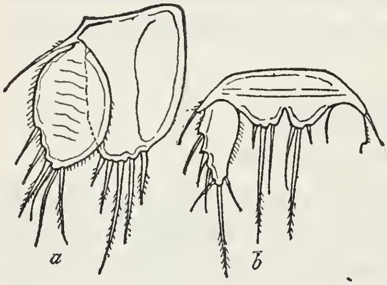

FIGURE 133.—*Thalestris gibba: a,* Female, fifth leg (after Sars); *b,* male, fifth leg. (From R. W. Sharpe, Proc. U. S. Nat. Mus., vol. 38, p. 418)

Remarks.—As remarked by Sharpe, this is apparently a boreal form that comes down into the present area from the north. When alive it can be recognized at once by its very dark color combined with its large size.

Genus HALITHALESTRIS G. O. Sars, 1905

Body elongate and subcylindrical; urosome not sharply separated from the metasome; head fused with the first segment, small and depressed; urosome 4-segmented, as large as metasome; caudal rami unusually elongated and strongly divergent, the apical setae of medium length. First antennae 9-segmented; exopod of second antennae 2-segmented; first four pairs of legs with 3-segmented rami; fifth legs 2-segmented, of medium size and foliaceous. One species found here.

HALITHALESTRIS CRONI (Krøyer)

FIGURE 134

Harpacticus croni KRØYER, Gaimard's voyage en Scandinavie, Atlas, pl. 43, fig. 3, *a–n*, 1845.

Halithalestris croni SARS, Crustacea of Norway, vol. 5, p. 118, pl. 72, 1905.

Occurrence.—Taken in surface tows at Stations 528 and 627, *Grampus*, July, 1894, the last station close to the tip of Cape Cod.

Distribution.—British Isles (Brady); coast of Spitzbergen (T. Scott); coast of Norway and Finmark (Sars); Greenland (Stephensen); Cape Cod (Sharpe).

Color.—Body semitransparent, of a light green color, deepened along the margins of the segments, and nearly always filled with clear oil bubbles of varying sizes.

Female.—Body possessing a peculiarly smooth appearance; genital segment fully as wide as the metasome, as long as wide, with lateral traces of a median division; caudal rami at least four times as long as wide, the longest apical seta about half the body length; urosome segments fringed along their posterior margins on the ventral surface with small spinules; ovisac large and single, reaching the middle of the caudal rami. First antenna not reaching the posterior margin of the cephalic segment; inner expansion of basal segment of fifth legs well developed and armed with five setae, the middle one the longest; distal segment oval, with six setae, the two apical ones short and very slender, the one next to them on either side considerably elongated. Total length, 2.2–2.45 mm.

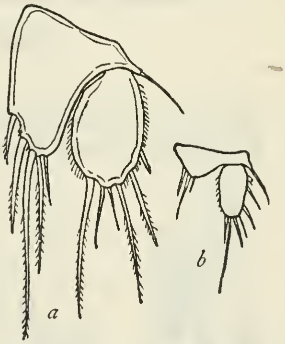

FIGURE 134.—*Halithalestris croni: a,* Female, fifth leg; *b,* male, fifth leg (after Sars). (From R. W. Sharpe, Proc. U. S. Nat. Mus., vol. 38, p. 418)

Male.—Smaller than the female; first antennae geniculate, the segments of the terminal portion more or less fused and clawlike. Exopod of first legs very slender and tipped with two unequal spines and a seta, all ciliated. Inner expansion of basal segment of fifth legs very short, broadly triangular, and armed with three setae; distal segment subovate, the inner margin ciliated, the outer margin sparsely setose, with three apical setae. Total length, 1.7–2 mm. (Called *Thalestris serrulata* by Brady.)

Remarks.—This is one of the largest harpactids and is pelagic in habit, frequenting the open sea at a distance from shore and near the surface. It can be recognized by its size and by the very long divergent caudal rami.

Genus MICROTHALESTRIS G. O. Sars, 1905

Body slender and subcylindrical, the urosome not sharply defined from the metasome; head fused with the first segment, the epimeral portions rather insignificant, but turned downward and partially inclosing the mouth parts; urosome 4-segmented and slightly tapered posteriorly; genital segment distinctly divided; caudal rami wider than long, inner apical seta two-thirds as long as the entire body. First antennae 9-segmented; exopod of second antennae 2-segmented; endopod of first legs 2-segmented, exopod and both rami of the three following pairs of legs 3-segmented; fifth legs 2-segmented in female, 4-segmented in male.

KEY TO THE SPECIES (FEMALES)

1. Distal segment of fifth legs with 8 setae, 2 apical and very unequal, 3 on outer and 3 on inner margin________________ forficula (p. 204)
2. Distal segment of fifth legs with 6 setae, 2 apical and subequal, 3 on outer and 1 on inner margin______________________ littoralis (p. 205)

MICROTHALESTRIS FORFICULA (Claus)

FIGURE 135

Thalestris forficula CLAUS, Die frei lebenden Copepoden, p. 131, pl. 17, 1863.
Microthalestris forficula SARS, Crustacea of Norway, vol. 5, p. 123, pl. 76, 1905.

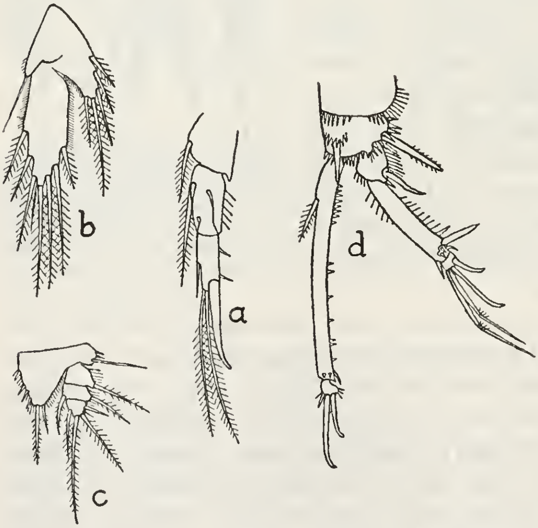

FIGURE 135.—*Microthalestris forficula*: *a*, Male, endopod of third leg; *b*, female, fifth leg; *c*, male, fifth leg; *d*, male, first leg

Occurrence.—Twenty specimens, including both sexes, were obtained in Penzance Pond, Woods Hole, August, 1925.

Distribution.—Mediterranean (Claus); British Isles (T. Scott); coast of Bohuslän (Cleve); Spitzbergen, Franz Josef Land (T. Scott); Polar islands, coast of Norway (Sars).

Color.—Body transparent and of a uniform pale yellow; ovary, oviducts, and eggs whitish; eye dull red.

Female.—Body narrow and elongated, four and one-half times as long as wide; cephalic segment short, somewhat compressed, its epimeral parts turned downward and inclosing the bases of the mouth parts; urosome cylindrical, each of its segments with a dense fringe of spinules along the posterior margin ventrally and laterally; genital segment divided; caudal rami more than twice as wide as long. First antennae densely clothed with long setae; exopod of first legs much shorter than endopod; inner expansion of fifth legs scarcely reaching the basal quarter of the distal segment, with five setae closely juxtaposed; distal segment narrowed at its tip, with eight setae, one of the apical pair less than half the length of the other and nonplumose. Total length, 0.4–0.5 mm.

Male.—Smaller than the female; first antennae geniculate, the terminal portion nearly as long as the basal. Endopod of third legs produced apically into a long stout spine and two setae; fifth legs much reduced in size, inner expansion of basal segment narrow-triangular, with two small setae; distal portion made up of three short segments of about the same length. Total length, 0.35 mm.

Remarks.—This species can be told by its small size and by the very long and slender 2-segmented endopod of the first legs; the 4-segmented fifth legs of the male are also unique. It has never before been reported from our American shores.

MICROTHALESTRIS LITTORALIS Sars

FIGURE 136

Microthalestris littoralis SARS, Crustacea of Norway, vol. 5, p. 369, suppl. pl. 11, fig. 1, 1911.

Occurrence.—Ten females were taken in a surface tow in Cuttyhunk Harbor, July, 1925, by the present author.

Distribution.—Coast of Norway (Sars); Adriatic (Steuer, Pesta); Gulf of Genoa (Brian).

Color.—Entire body semitransparent and whitish, with a tinge of yellow in the metasome and along the margins of the segments; eye reddish.

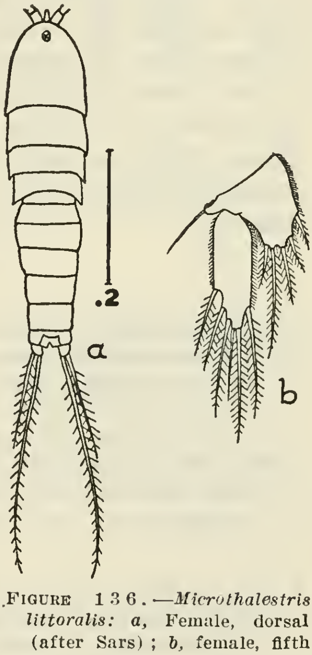

FIGURE 136.—*Microthalestris littoralis: a,* Female, dorsal (after Sars); *b,* female, fifth leg

Female.—Body a little stouter than in the preceding species, and the epimeral plates better developed; urosome segments fringed with spinules as in the preceding species; genital segment often only indistinctly divided; caudal rami one-half wider than long, densely setose on the lateral margins and both surfaces. First exopod relatively longer than in *forficula;* inner expansion of basal segment of fifth legs quadrangular, somewhat squarely truncated at the tip, which almost reaches the center of the distal segment and is armed with five setae, well separated from one another; distal segment narrowed at the tip, with two apical setae of about equal length, three setae on the outer and one on the inner margin. Total length, 0.5–0.6 mm.

Male.—Unknown.

Remarks.—Brian has published good figures and descriptions of the nauplius, metanauplius, and copepodid stages of this copepod in Studi del Laboratorio Marino Genova, 1921 (pp. 79–80). The species can be distinguished from the preceding by the structure of the fifth legs and the caudal rami; like *forficula* it has never before been reported from this side of the Atlantic.

Genus DACTYLOPUSIA Norman, 1903

Body stout, tapering posteriorly; head fused with the first segment and more or less depressed; urosome not sharply defined from the metasome, 4-segmented in both sexes; genital segment partly divided; caudal rami much wider than long. First antennae short, the number of segments various; exopod of second antennae 3-segmented; first four pairs of legs with 3-segmented rami, endopod of second pair modified in male; fifth legs 2-segmented, broad and lamellar.

KEY TO THE SPECIES

FEMALES

1. Fifth legs showing a regular row of short transverse chitin ribs------------ 2
   Neither segment of fifth legs showing any traces of chitin ribs; first antennae very short and stout, 5-segmented------ **brevicornis** (p. 206)
2. A single row of chitin ribs along inner margin of basal expansion of fifth legs; first antennae 8-segmented------------ **tisboides** (p. 207)
   Two rows of chitin ribs, one on basal expansion, the other on distal segment, along inner margins; first antennae 9-segmented-- **vulgaris** (p. 209)

MALES

1. Inner expansion of basal segment of fifth legs removed from, and shorter than, distal segment, which is armed with 5 setae---------- 2
   Inner expansion of basal segment of fifth legs close to, and as long as, distal segment, which is armed with 7 setae----- **vulgaris** (p. 209)
2. Distal segment of second endopod twice as long as wide, with 2 unequal apical spines and a very stout outer spine------- **tisboides** (p. 207)
   Distal segment of second endopod as wide as long, with 1 bent spine at outer corner and an outer fringe of cilia------ **brevicornis** (p. 206)

DACTYLOPUSIA BREVICORNIS (Claus)

FIGURE 137

Dactylopus brevicornis CLAUS, Die Copepodenfauna von Nizza, p. 29, pl. 3, 1866.
Dactylopusia brevicornis SARS, Crustacea of Norway, vol. 5, p. 130, pl. 80, 1905.

Occurrence.—Found in small numbers in Penzance Pond, Woods Hole, Great Pond, Falmouth, and one of the brackish ponds on

Chappaquiddick Island, July, 1925; found in abundance in Penzance Pond and Sengekontacket Pond, Marthas Vineyard, July, 1926.

Distribution.—Mediterranean (Claus); British Isles (T. Scott, Brady); coast of Norway (Sars); Gulf of Genoa (Brian).

Color.—Body transparent and yellow, faintly tinged with brown; posterior portion of thorax and abdomen inclined to orange; eggs bluish white and opaque; eye yellowish red.

Female.—Metasome short and stout, cephalic segment as long as the thorax; urosome quite sharply defined from the metasome; genital segment divided laterally; caudal rami twice as wide as long. First antennae very stout and exceptionally short, 5-segmented and densely setose; exopod of first legs nearly as long as endopod, both rami somewhat widened; distal segment of fifth legs oval, narrowed toward the tip, with two very unequal apical setae, three on outer margin and one on inner margin; inner expansion of basal segment with five setae. Total length, 0.5–0.65 mm.

Male.—Inner distal corner of second basipod of first legs with a stout spine bent inward at right angles near its center; distal segment of second endopod as wide as long, armed at its tip with a stout outer spine, also bent at right angles near the center; the outer margin of this segment is fringed with long cilia; inner expansion of basal segment of fifth legs removed from, and much shorter than, the distal segment, and armed with three setae; distal segment with five setae. Total length, 0.45–0.55 mm.

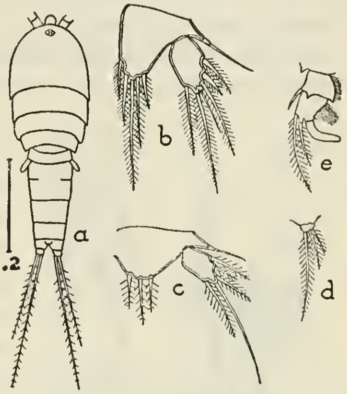

FIGURE 137.—*Dactylopusia brevicornis: a,* Female, dorsal; *b,* female, fifth leg; *c,* male, fifth leg; *d,* male, sixth leg; *e,* male, endopod of second leg

Remarks.—This copepod may be recognized by the remarkably short first antennae and the structure of the fifth legs; it has never before been reported from American shores. Brian has given good figures and descriptions of development stages of this species in Studi del Laboratorio Marino Genova, 1921 (pp. 82–84).

DACTYLOPUSIA TISBOIDES (Claus)

FIGURE 138

Dactylopus tisboides CLAUS, Die frei lebenden Copepoden, p. 127, pl. 16, 1863.
Dactylopusia thisboides SARS, Crustacea of Norway, vol. 5, p. 126, pls. 77, 78, 1905.

Occurrence.—Found in small numbers in one of the brackish ponds on Chappaquiddick Island and in Great Pond, Falmouth; found in abundance in Cuttyhunk Harbor; Penzance Pond and the Eel Pond, Woods Hole; Katama Bay, Menemsha Pond, and Nashaquitsa Pond, Marthas Vineyard.

Distribution.—British Isles (Brady); coast of France (Canu); Mediterranean (Claus); Red Sea (A. Scott); Bear Island, Franz Josef Land (T. Scott); Adriatic (Car, Graeffe, Grandori, Pesta); coast of Greenland (Stephensen); Kerguelen Island (Brady); Kiel Bay (Giesbrecht); Gulf of Genoa (Brian); coast of Norway (Sars); Little Harbor, Woods Hole (Sharpe).

Color.—Body golden yellow, with a narrow transverse band of light chestnut-brown across the anterior margin of the genital segment; eye dark red.

Female.—Metasome conspicuously enlarged, the cephalic segment broad, depressed, and evenly rounded anteriorly; urosome more than half the length of the metasome; caudal rami twice as wide as long. First antennae 8-segmented and densely setose, the terminal portion 4-segmented and two-thirds as long as the basal; first endopod much longer than the exopod, the terminal claws of both rami only slightly curved and spinulose along their concave margins; inner expansion of basal segment of fifth legs broadly foliaceous, reaching the tip of the distal segment, with a row of prominent transverse chitin ribs along its inner margin, and with five apical setae, the middle one elongate; distal segment with six setae, the third inner one short and hairlike. Ovisac single, pear-shaped, and reaching beyond the tips of the caudal rami. Total length, 0.85–1.1 mm.

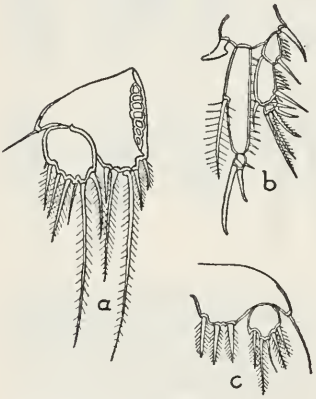

FIGURE 138.—*Dactylopusia tisboides: a,* Female, fifth leg; *b,* male, first leg; *c,* male, fifth leg

Male.—Smaller than female, the urosome relatively more slender; first antennae geniculate, the terminal portion less than half the length of the basal, the aesthetask on the third segment as long as the entire antenna; distal segment of second endopod twice as long as wide, with a very stout spine on its outer margin; inner expansion of basal segment of fifth legs with three equal setae, distal segment as wide as long, with five setae, one of which is slender and nonplumose. Total length, 0.7–0.9 mm.

Remarks.—This is the largest of our American species of the genus, and is most easily recognized by the prominent row of chitin ribs on the fifth legs.

DACTYLOPUSIA VULGARIS Sars

FIGURE 139

Dactylopus strömi CLAUS, Die frei lebenden Copepoden, p. 126, pl. 16, 1863.
Dactylopusia vulgaris SARS, Crustacea of Norway, vol. 5, p. 128, pl. 79, fig. 1, 1905.

Occurrence.—Two females in a surface tow in Great Pond, Falmouth; found by Sharpe in Little Harbor and among *Fucus* on the Bureau of Fisheries wharf, Woods Hole.

Distribution.—British Isles (Brady); coast of France (Canu); Helgoland (Claus); coast of Bohuslän (Cleve); coast of Norway (Sars); Charlestown Pond, R. I. (Williams); Woods Hole (Sharpe).

Color.—Body dark yellow to olivaceous-brown, deepened along the margins of the segments and in the grooves between them; eye bright red.

Female.—Body short and stout and much depressed; urosome scarcely half as long as metasome, each of its segments fringed with spinules along the posterior margin; genital segment distinctly divided; caudal rami about three times as wide as long. First antennae 9-segmented; apical claws of rami of first legs slender, slightly curved, and spinulose; both segments of fifth legs with a row of transverse chitin ribs along the inner margin, basal expansion with five setae, the second outer one the longest; distal segment narrowed at the tip, with two apical setae, the outer of which is nonplumose and half the length of the inner, three outer and one inner setae. Total length, 0.6–0.75 mm.

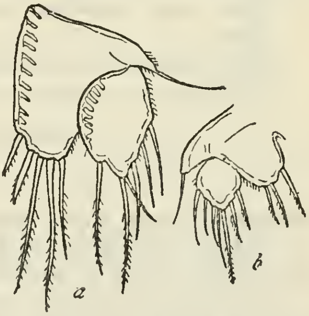

FIGURE 139.—*Dactylopusia vulgaris: a,* Female, fifth leg; *b,* male, fifth leg. (From R. W. Sharpe, Proc. U. S. Nat. Mus., vol. 38, p. 420)

Male.—Smaller than female; first antennae geniculate, the terminal portion shortened and the aesthetask lengthened; distal segment of second endopod twice as long as wide, with two apical spines of equal length, and a longer, slender spine on the outer margin; distal segment of fifth legs armed with seven setae, only one of which is reduced in size and nonplumose. Total length, 0.5–0.6 mm.

Remarks.—This species can be told by its small size and by the presence on both segments of the fifth legs of the transverse chitin ribs. Sars said it was one of the most common harpactids on the Norway coast, but in the present area it is not so common as the other two species of the genus.

Genus PSEUDOTHALESTRIS Brady, 1883

Body short and stout, somewhat pear-shaped; head fused with the first segment, very large and highly vaulted dorsally; urosome sharply defined from the metasome, 4-segmented and much-tapered posteriorly; caudal rami nearly twice as wide as long. First antennae 5- to 7-segmented, slender; exopod of second antennae 3-segmented; exopod of first legs 2-segmented, sometimes the two segments fused; endopod and both rami of the three following pairs of legs 3-segmented; second endopod modified in male; fifth legs 2-segmented, of the usual form in female, somewhat modified in male. Ovisac single and pear-shaped.

KEY TO THE SPECIES (BOTH SEXES)

1. Small; first antennae slender and elongate, 6- or 7-segmented; two segments of first exopod distinctly separated ______________________ 2
   Much larger; first antennae only 5-segmented, short and stout; segments of first exopod fused __________________________ **nobilis** (p. 210)
2. First antennae 6-segmented; inner expansion of basal segment of fifth legs reaching to or beyond tip of distal segment ____ **minuta** (p. 211)
   First antennae 7-segmented; inner expansion of basal segment of fifth legs not reaching beyond base of distal segment __ **pygmaea** (p. 212)

PSEUDOTHALESTRIS NOBILIS (Baird)

FIGURE 140

Arpacticus nobilis BAIRD, The natural history of the British Entomostraca, p. 214, pl. 28, fig. 2, *a–e*, 1850.

Westwoodia nobilis SARS, Crustacea of Norway, vol. 5, p. 140, pls. 85, 86, 1906.

Occurrence.—Fifteen females from Penzance Pond, Woods Hole, August, 1925; 15 males and females from Little Harbor, Woods Hole, September, 1881; a single female from one of the brackish ponds on Chappaquiddick Island, July, 1926.

Distribution.—British Isles (Baird, T. Scott, Brady); Helgoland (Claus); coast of France (Canu); coast of Bohuslän (Cleve); Lofoten Islands (T. Scott); coast of Norway (Sars); Adriatic (Car, Graeffe, Grandori, Pesta); Gulf of Genoa (Brian).

Color.—Body light yellowish brown, ornamented with a very variegated pattern of deep brownish-red pigment, especially noticeable in lateral view; eye dark ruby red.

Female.—Body robust; metasome considerably compressed, epimeral plates of moderate size and rounded at the corners; rostrum broadly triangular, sharply pointed and depressed; urosome less than half the length of the metasome; genital segment divided laterally; caudal rami twice as wide as long, the two middle apical setae enlarged and elongated. First antennae 5-segmented, stout; inner expansion of basal segment of fifth legs reaching the tip of the distal segment, and armed with five elongated setae; distal segment oblong, with one apical seta, three on the outer, and one on the inner margin. Total length, 0.75–0.9 mm.

Male.—First antennae 7-segmented, geniculate, the terminal portion made up of two segments; spine at inner corner of second basipod of first legs broad and spatulate at its tip; endopod of second legs 2-segmented, distal segment obliquely oval, with two apical spines, the inner one dirk-shaped; fifth legs smaller than in female, the basal expansion shorter than the distal segment and subquadrangular. Total length, 0.7–0.8 mm.

Remarks. — This species has never before been reported from American shores. Sars said of it: "It occurs in the littoral and sublittoral zones among algae, and is sometimes even left in tidal pools." Some of the developmental stages are figured and described by Brian in Studi del Laboratorio Marino Genova, 1921 (pp. 84–85).

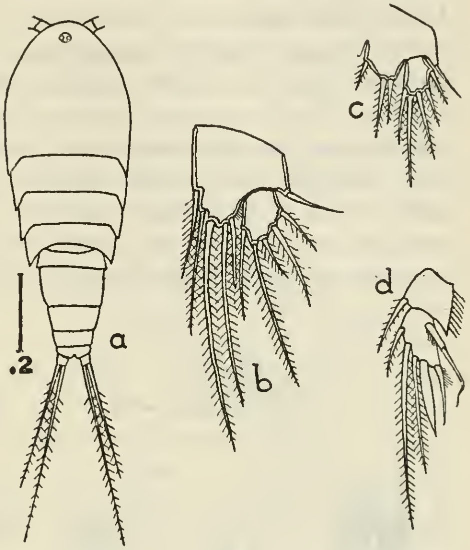

FIGURE 140.—*Pseudothalestris nobilis: a,* Female, dorsal (after Sars); *b,* female, fifth leg; *c,* male, fifth leg; *d,* male, endopod of second leg

PSEUDOTHALESTRIS MINUTA (Claus)

FIGURE 141

Westwoodia minuta CLAUS, Die frei lebenden Copepoden, p. 118, pl. 21, 1863.—SARS, Crustacea of Norway, vol. 5, p. 142, pl. 88, fig. 1, 1906.

Occurrence.—Eight specimens, including both sexes, from a surface tow in Little Harbor, Woods Hole, September, 1881, by Rathbun.

Distribution.—British Isles (Brady, T. Scott); Helgoland (Claus); coast of Norway (Sars); Woods Hole (Fish).

Color.—Body light chestnut-brown, a patch behind the eye, a transverse streak across the center of the cephalic segment, and the posterior margin of the same segment much darker in color; eye dark red.

Female.—Body short, stout, and decidedly pear-shaped; metasome segments telescoped one inside another; cephalic segment more than half the length of the entire body; urosome very short and narrow;

genital segment divided; the longest caudal seta more than twice the length of the urosome. First antennae 6-segmented, the terminal portion made up of two segments; basal expansion of fifth legs reaching beyond the tip of the distal segment and armed with five slender setae, the second outer one the longest; distal segment small oval, with one elongated apical seta, three on the outer, and one on the inner margin. Total length, 0.4–0.55 mm.

Male.—Distal segment of second endopod elliptical, with two terminal spines, the inner one broad and dagger-shaped, and one on the outer margin, also dagger-shaped; basal expansion of fifth legs smaller than in the female, not reaching the tip of the distal segment and armed with three setae, two apical and one at the center of the inner margin. Total length, 0.3–0.45 mm.

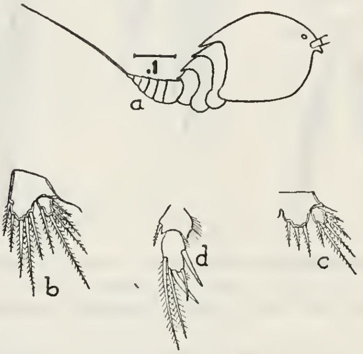

FIGURE 141.—*Pseudothalestris minuta: a*, Female, lateral (after Sars); *b*, female, fifth leg; *c*, male, fifth leg; *d*, male, endopod of second leg

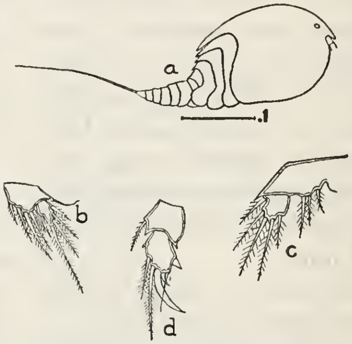

FIGURE 142.—*Pseudothalestris pygmaea: a*, Female, lateral (after Sars); *b*, female, fifth leg; *c*, male, fifth leg; *d*, male, endopod of second leg

Remarks.—This species can be separated from the other two by the details of the fifth legs, and by the 6-segmented first antennae. Sars made the following curious statement with reference to this copepod when alive: "When disturbed, the animal secretes a clear viscid fluid in considerable quantity. From which organ this matter is derived I have not yet been enabled to determine."

PSEUDOTHALESTRIS PYGMAEA (T. Scott)

FIGURE 142

Pseudowestwoodia pygmaea T. SCOTT, Ann. Mag. Nat. Hist., ser. 6, vol. 15, p. 55, pl. 6, 1895.

Westwoodia pygmaea SARS, Crustacea of Norway, vol. 5, p. 143, pl. 88, fig. 2, 1906.

Occurrence.—A single female was taken in a surface tow in Little Harbor, Woods Hole, September, 1881, by Rathbun.

Distribution.—Scottish coast (T. Scott); coast of Norway (Sars).

Color.—Body yellowish white, irregularly shaded with light brown; eye dark red.

Female.—Body much resembling that of the previous species, but shorter and thicker, with the metasome segments more completely telescoped; cephalic segment twice as long as the rest of the body, strongly arched dorsally; genital segment divided; longest seta of caudal rami three times the length of the urosome. First antennae short, but 7-segmented, terminal portion made up of the last three segments; basal expansion of fifth legs almost obsolete, not reaching beyond the base of the distal segment and armed with five short setae; distal segment small and narrowed at its tip, the apical seta the longest. Total length, 0.3–0.35 mm.

Male.—First antennae geniculate, the terminal portion containing three segments; distal segment of second endopod broad and angular, with two apical spines, the inner one wide and sickle-shaped, the outer one very short and triangular; the spine on the outer margin is also short and triangular; fifth legs like those of the female, the basal expansion reduced to almost nothing and armed with three small setae; distal segment with five setae. Total length, 0.27–0.32 mm.

Remarks.—This is a dwarf species and may be distinguished by that character and by the reduction of the basal expansion in the fifth legs. It is found in moderate depths among algae, and has not before been reported from our shores.

Family DIOSACCIDAE

Genus DIOSACCUS Boeck, 1872

Metasome strongly compressed; head fused with the first segment, its epimeral portions extended ventrally to inclose the mouth parts; rostrum large and prominent; urosome 4-segmented, tapered posteriorly; genital segment divided; the anterior half inflated laterally. First antennae 8-segmented; exopod of second antennae 1-segmented; first four pairs of legs with 3-segmented rami; second endopod 2-segmented and modified in the male; fifth legs 2-segmented in female, 1-segmented in male, the setae partly spiniform. Two ovisacs. One species found here.

DIOSACCUS TENUICORNIS (Claus)

FIGURE 143

Dactylopus tenuicornis CLAUS, Die frei lebenden Copepoden, p. 127, pl. 16, 1863.
Diosaccus tenuicornis SARS, Crustacea of Norway, vol. 5, p. 146, pls. 89, 90, 1906.

Occurrence.—Found in small numbers in Eel Pond, Woods Hole; Great Pond, Falmouth; Katama Bay and Nashaquitsa Pond, Marthas Vineyard; one of the brackish ponds on Chappaquiddick Island.

Found in great abundance in Penzance Pond, Woods Hole, and Sengekontacket Pond, Marthas Vineyard.

Distribution.—British Isles (Brady, Bourne); coast of Bohuslän (Cleve); Mediterranean (Claus); coast of Norway (Sars); North Sea (Timm); Adriatic (Car, Graeffe, Steuer, Grandori, Pesta); Wickford, Charlestown Pond, R. I. (Williams); Woods Hole (Sharpe).

Color.—Entire cephalothorax, the tips of the swimming legs and the ovisacs golden yellow faintly washed with brown; remainder of body and appendages light brown, often tinged with blue; eggs pale blue; eye bright red.

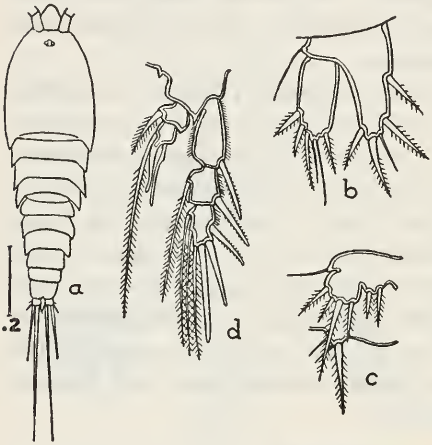

FIGURE 143.—*Diosaccus tenuicornis: a,* Female, dorsal (after Sars); *b,* female, fifth leg; *c,* male, fifth and sixth legs; *d,* male, second leg

Female.—Cephalic segment about half the body length, strongly compressed, the epimeral portions turned downward and inclosing the mouth parts; rostrum very prominent, curved downward, and blunt at the tip; genital segment divided, the anterior half dilated; caudal rami close together, their apical setae nearly parallel. First antennae very long and slender; basal expansion of fifth legs reaching beyond the tip of the distal segment, tongue-shaped, with three apical setae and two on the inner margin; distal segment twice as long as wide with six unequal setae, the inner and three outer ones plumose, the other two slender and hairlike. Total length, 0.7–0.9 mm.

Male.—First antennae prehensile, the five distal segments turned outward; second basipod of first legs with a small inner lappet; endopod of second legs scarcely as long as the basal exopod segment, its distal segment subspherical, with a curved apical spine and an outer setiform spine, both denticulate; segments of fifth legs completely fused, basal expansion with two unequal setae, distal portion with four setae, the second outer one hairlike; rudimentary sixth legs present. Total length, 0.6–0.7 mm.

Remarks.—This species may be distinguished by the prominent rostrum, the long antennae, and the details of the fifth legs. It frequents the littoral zone among algae, and it is frequently left in tide pools.

Genus AMPHIASCUS G. O. Sars, 1905

Body slender and cylindrical; head fused with the first segment; urosome 4-segmented in female, 5-segmented in male, not sharply defined from metasome; rostrum often large and prominent; genital segment imperfectly divided in female, entire in male. First antennae 8-segmented; exopod of second antennae 3-segmented, the middle segment very short; rami of first four pairs of legs 3-segmented; second endopod modified in male; fifth legs 2-segmented, large and foliaceous in female, much smaller in male. Two ovisacs. Body showing distinctive coloration in the different species.

KEY TO THE SPECIES

FEMALES

1. Terminal segment of fifth legs with 7 marginal setae, the third inner one nonplumose and hairlike; entire body, except dorsal surface of head, dark chocolate-brown ---- **obscurus** (p. 216)
   Terminal segment of fifth legs with 6 marginal setae, the second and third inner ones nonplumose and hairlike; body light colored ---- 2
   Terminal segment of fifth legs with 5 marginal setae, the middle one nonplumose and hairlike; body light colored ---- 8
2. Longest apical seta of caudal rami with a conspicuous swelling at its base, overlapping the seta outside of it ---- 3
   None of the apical setae of caudal rami swollen at their base ---- 4
3. Exopod of first legs as long as basal endopod segment or longer; rostrum slender and acuminate ---- **longirostris** (p. 217)
   Exopod of first legs distinctly shorter than basal endopod segment; rostrum broadly triangular and blunt ---- **attenuatus** (p. 218)
4. Exopod of first legs definitely longer than basal endepod segment; eye not visible ---- **pallidus** (p. 219)
   Exopod of first legs definitely shorter than basal endopod segment; eye visible ---- 5
5. Two distal segments of first endopod about same length and together much less than half the length of basal segment ---- 6
   End segment of first endopod twice as long as second segment, the two together much more than half the length of the basal segment ---- 7
6. End segment of third exopod with 2 apical setae and 1 on inner margin; adults less than 0.5 mm. long ---- **parvus** (p. 221)
   End segment of third exopod with 2 apical setae and 3 on inner margin; adults more than 0.75 mm. long ---- **cinctus** (p. 221)
7. End segment of third exopod with 2 apical setae and 1 on inner margin; caudal rami twice as wide as long ---- **sinuatus** (p. 222)
   End segment of third exopod with 2 apical setae and 3 on inner margin; caudal rami twice as wide as long ---- **dactylifer**, new species (p. 223)
8. Caudal rami longer than wide; outer apical seta swollen at its base ---- **hispidus** (p. 225)
   Caudal rami twice as wide as long; outer apical seta not swollen at its base ---- 9

9. Rostrum distinctly bifid at its tip; genital segment with only faint lateral indications of division________________ intermedius (p. 226)
   Rostrum not bifid at tip; genital segment distinctly divided through its center________________________________ commensalis (p. 227)

MALES

1. Terminal segment of fifth legs with 6 marginal setae, third inner one nonplumose and hairlike____2
   Terminal segment of fifth legs with 5 marginal setae, middle one nonplumose and hairlike____5
   Terminal segment of fifth legs with 4 marginal setae, 2 inner plumose, third filiform, fourth spiniform__ dactylifer, new species (p. 223)
2. Second basipod of first legs with 1 long spine at inner corner, reaching beyond center of basal endopod segment__________________________3
   Second basipod of first legs with 2 or more short spines on inner margin, not reaching base of basal endopod segment_____________________4
3. Long spine bent abruptly outward beyond its center; second, third, and fourth metasome segments pink, rest of body white ____ cinctus (p. 221)
   Long spine curved inward; entire body behind cephalic segment a dark chocolate-brown _____________________________ obscurus (p. 216)
4. Inner margin of second basipod of first legs with 4 equal short, straight, and sharply pointed spines________________ longirostris (p. 217)
   Inner margin of second basipod of first legs with small proximal knob and 2 blunt spines, sometimes fused______________ pallidus (p. 219)
   Inner margin of second basipod of first legs with small proximal knob and 1 curved blunt spine______________________ attenuatus (p. 218)
5. Basal expansion of fifth legs short and broad, not reaching center of distal segment; 2 or 3 short unequal setae__________ hispidus (p. 225)
   Basal expansion of fifth legs long and narrow, reaching tip of distal segment; 2 long and equal setae________________ sinuatus (p. 222)
   Basal expansion of fifth legs short and broad, reaching beyond center of distal segment; 2 medium equal setae____ commensalis (p. 227)

AMPHIASCUS OBSCURUS Sars

FIGURE 144

Amphiascus obscurus SARS, Crustacea of Norway, vol. 5, p. 150, pl. 93, 1906.

Occurrence.—A few specimens of both sexes were found in two of the brackish ponds on Chappaquiddick Island.

Distribution.—Norwegian coast (Sars); Woods Hole Harbor (Fish).

Color.—Dorsal surface of cephalic segment light yellow tinged with brown; the rest of the body a dark chocolate-brown, changing into deep indigo-blue on the caudal rami and the ventral appendages; eye bright red.

Female.—Cephalic segment as long as the rest of the metasome; rostrum elongate triangular, bluntly pointed; segments of urosome fringed with coarse spinules along their posterior margins on the ventral and lateral surfaces; caudal rami wider than long, massive and close together. First exopod three-fourths as long as basal endopod segment; end segment of third exopod with four setae and four spines; distal segment of fifth legs foliaceous, as wide as long, overlapping the basal expansion, with seven large setae, third inner one filiform; basal expansion reaching beyond center of distal segment, with five setae, all plumose, middle one longest. Total length, 0.9–1.1 mm.

Male.—Second basipod of first legs with a slender and nearly straight inner spine, reaching beyond the center of the basal endopod segment; endopod of second leg nearly as long as exopod, its end segment with a slender apical spine, curved outward, and two stout outer spines, the proximal one widened; distal segment of fifth legs as wide as long, with six setae, the third outer one filiform; basal expansion very short, with two equal apical setae. Total length, 0.75–0.9 mm.

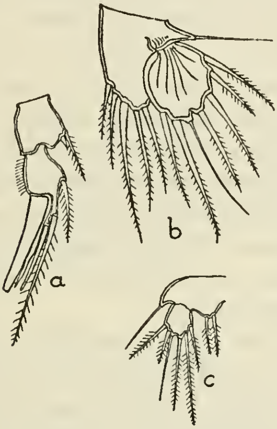

FIGURE 144.—*Amphiascus obscurus: a,* Male, endopod of second leg; *b,* female, fifth leg; *c,* male, fifth leg

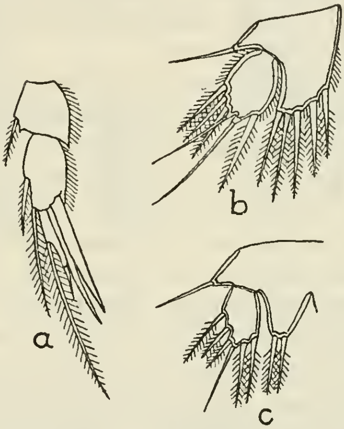

FIGURE 145.—*Amphiascus longirostris: a,* Male, endopod of second leg; *b,* female, fifth leg; *c,* male, fifth leg

Remarks.—When alive this species can be easily distinguished by its color; when preserved the seven large setae on the distal segment of the fifth legs furnish the best single character. The presence of the species in the brackish ponds on Chappaquiddick Island shows that it is probably well distributed elsewhere in the area.

AMPHIASCUS LONGIROSTRIS (Claus)

FIGURE 145

Dactylopus longirostris CLAUS, Die frei lebenden Copepoden, p. 127, pl. 18, 1863.
Amphiascus longirostris SARS, Crustacea of Norway, vol. 5, p. 159, pls. 100, 101, 1906.

Occurrence.—Twenty specimens, including both sexes, were taken in one of the brackish ponds on Chappaquiddick Island, August, 1926.

Distribution.—Helgoland (Claus); British Isles (T. Scott); Norwegian coast (Sars); Finmark coast (T. Scott).

Color.—Body light yellow, irregularly tinged with red, the digestive tract usually dark brown; eye bright red.

Female.—Fifth metasome segment as wide as the fourth; urosome segments fringed posteriorly on the ventral and lateral surfaces with spinules; caudal rami wider than long, the inner apical seta conspicuously swollen near its base, overlapping the outer seta. Exopod of first leg as long as basal endopod segment; end segment of third exopod with four spines and four setae, one of the latter almost obsolete; distal segment of fifth legs oval, longer than wide, with six setae, the two apical ones filiform; basal expansion reaching beyond center of distal segment, with five subequal plumose setae. Total length, 0.7–0.85 mm.

Male.—Inner margin of second basipod of first legs armed with three or four short, sharp spines, directed obliquely inward; distal segment of second endopod with a short apical seta and two stout outer spines, the proximal one widened; the two proximal segments of the second exopod each with two exceptionally stout spines, one inside the base of the other; distal segment of fifth legs oval, with six setae, the single apical one filiform; basal expansion conical, with two equal setae. Total length, 0.65–0.75 mm.

Remarks.—This species can be recognized by the long and sharply pointed rostrum and the swollen base of the inner apical seta of the caudal rami. It has not been reported before from our coasts, but it is likely to be found in other ponds of the Woods Hole area besides the one mentioned above.

AMPHIASCUS ATTENUATUS Sars

FIGURE 146

Amphiascus attenuatus SARS, Crustacea of Norway, vol. 5, p. 171, pl. 112, 1906.

Occurrence.—Fifty specimens, including both sexes, were found in Penzance Pond, Woods Hole, August, 1925.

Distribution.—West coast of Norway (Sars).

Color.—Body semitransparent and whitish in color, banded with pale brown as follows: First a chain of spots across the posterior portion of the cephalic segment, consisting of a central H-shaped mark, on each side of which is a semilunar disk inclined forward and outward, and beyond it a circular dot; transverse bands across the center of the second and third segments, near the posterior margin of the fourth segment, near the anterior margin of the genital segment, and on the dividing grooves between the abdominal segments. Eye bright red.

Female.—Cephalic segment one-half longer than wide; rostrum triangular and bluntly rounded at the tip; urosome about two-thirds as long as metasome, its segments without spinules; caudal rami wider than long, the inner apical setae with a conspicuous bulge near the base. First antennae 9-segmented, the first four segments of about the same length, the last five much shorter and together scarcely longer than the fourth segment; exopod of first legs definitely shorter than basal endopod segment; end segment of third exopod with four setae and four denticulate spines; distal segment of fifth legs oval, with six setae, the two apical ones filiform, basal expansion reaching center of distal segment, obliquely truncated, with five setae. Total length, 0.8–0.85 mm.

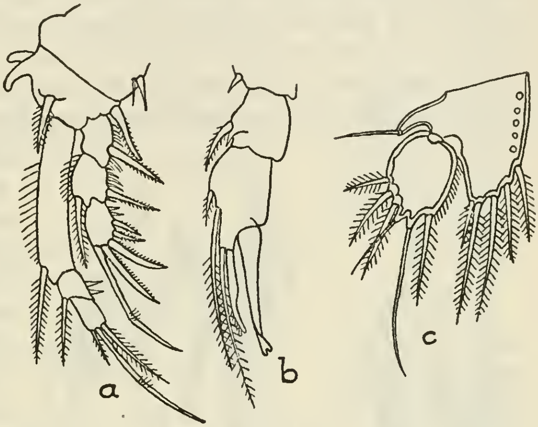

FIGURE 146.—*Amphiascus attenuatus: a,* Male, first leg; *b,* male, endopod of second leg; *c,* female, fifth leg

Male.—Body more slender and urosome longer than in female; second basipod of first legs with a pair of curved and bluntly pointed processes on inner margin; spines on outer margin of first exopod unusually long and denticulate; distal segment of second endopod with two apical setae, the outer one thickened and spiniform, and a single outer spine, which is flattened, twisted, and emarginate at the tip; distal segment of fifth legs with six setae, the third inner one filiform, basal expansion much reduced, with two setae. Total length, 0.7–0.8 mm.

Remarks.—This is the first report of this species outside of the original locality on the Norwegian coast. When alive it can be recognized at once by the transverse brown bands, which remain visible long after preservation, and by the conspicuous bulge on the inner apical setae of the caudal rami.

AMPHIASCUS PALLIDUS Sars

FIGURE 147

Amphiascus pallidus SARS, Crustacea of Norway, vol. 5, p. 164, pl. 105, 1906.

Occurrence.—Found in abundance in the Eel Pond, at Woods Hole, in two of the brackish ponds on Chappaquiddick Island, and along the shores of Katama Bay, Marthas Vineyard, July, 1926; always among algae.

Distribution.—Coast of Norway (Sars).

Color.—Body transparent, of a faint yellowish-gray tinge, the contents of the digestive tract a bright red; eggs grayish white; eye brick red.

Female.—Urosome three-fifths as long as metasome, its segments densely fringed with spinules along the posterior margins on the ventral and lateral surfaces; caudal rami wider than long, the inner apical setae thickened at their bases.

First antennae 8-segmented, the four terminal segments combined twice as long as the fourth segment; exopod of first legs longer than basal endopod segment; distal segment of third exopod with four spines and four setae, one of the latter almost obsolete; distal segment of fifth legs oval, with six setae, the two apical ones filiform, basal expansion reaching beyond center of distal segment, obliquely truncated, with five stout plumose setae, the second and third outer ones subequal and much longer than the others. Total length, 0.6–0.75 mm.

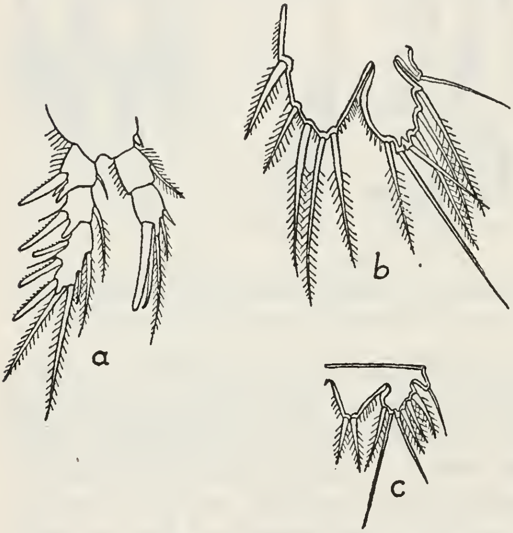

Figure 147.—*Amphiascus pallidus: a,* Male, second leg; *b,* female, fifth leg; *c,* male, fifth leg

Male.—Second basipod of first legs with two curved blunt processes and an acuminate spine on the inner margin; distal segment of second endopod swollen through the middle, with a single long apical seta and two outer spines, the proximal one much the larger and blunt at its tip; fifth legs much reduced in size, basal expansion conical, tipped with two equal setae, distal segment short and narrow, with six setae, the apical one filiform. Total length, 0.5–0.65 mm.

Remarks.—This copepod lives crawling about through the meshes of the blanket algae that cover the ponds on Chappaquiddick Island. It feeds largely on red diatoms, a fact that accounts for the color of its digestive tract. Some of the algae was brought home and placed in a shallow aquarium, and the copepods remained alive for 18 days, long before which the algae had developed enough stench to render it decidedly obnoxious.

AMPHIASCUS PARVUS Sars

FIGURE 148

Amphiascus parvus SARS, Crustacea of Norway, vol. 5, p. 162, pl. 103, 1906.

Occurrence.—A single female was obtained in a surface tow from the wharf of the Bureau of Fisheries at Woods Hole, August, 1925. The specimen was captured by C. H. Blake, who was working upon copepods at the Marine Biological Laboratory. It was carefully dissected and mounted, and the present author was kindly allowed to examine the mount and drawings and to include it in the present list.

Distribution.—Coast of Norway (Sars).

Color.—Body grayish white, somewhat darker in the grooves between the segments; contents of the digestive tract more or less tinged with red; eye brick red.

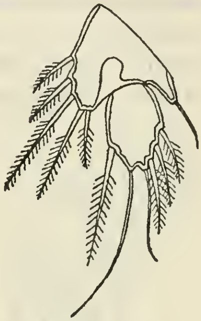
FIGURE 148.—*Amphiascus parvus:* Female, fifth leg

Female.—Body slender, more than four times as long as wide; urosome two-thirds as long as metasome and nearly as wide, its segments without spinules; caudal rami twice as wide as long, the bases of both apical setae enlarged. First antennae 8-segmented, the four terminal segments about half the length of the four basal ones; first exopod reaching but little beyond the center of the basal endopod segment, its middle segment without a seta; distal segment of third exopod with four spines and two setae; distal segment of fifth legs oval, with six setae, the two apical ones filiform, basal expansion not reaching the middle of the distal segment, obliquely truncated, with five unequal setae. Total length, 0.45 mm.

Male.—Unknown.

Remarks.—Again this is the first record of the species outside the Norwegian coast. It may be recognized by its small size and by the structure of the first and fifth swimming legs.

AMPHIASCUS CINCTUS (Claus)

FIGURE 149

Dactylopus cinctus CLAUS, Die Copepodenfauna von Nizza, p. 27, pl. 3, 1866.
Amphiascus cinctus SARS, Crustacea of Norway, vol. 5, p. 149, pls. 91, 92, 1906.

Occurrence.—Found in limited numbers in Penzance Pond, Woods Hole; Great Pond, Falmouth; Waquoit Bay, Falmouth; Sengekontacket Pond, Marthas Vineyard.

Distribution.—Mediterranean (Claus); coast of Norway (Sars); Adriatic (Pesta, Grandori); Gulf of Genoa (Brian).

Color.—Body light yellowish white, the first three free segments of the metasome a deep reddish pink, forming a wide transverse band; there is also a longitudinal streak of very irregular width along the midline of the dorsal surface; eye orange-red.

Female.—Cephalic segment about half of the metasome; rostrum long, prominent, curved downward, and rounded at its tip, with a minute hair on each lateral margin; urosome two-thirds as long as metasome, without spinules; genital segment divided; caudal rami quadrilateral, wider than long. First antennae 8-segmented, two basal segments enlarged; exopod of first legs three-fourths as long as basal endopod segment; distal segment of third exopod with four spines and four setae; distal segment of fifth legs large and foliaceous, as wide as long, with six setae, the third inner one filiform, basal expansion triangular, scarcely reaching the center of the distal segment, with five setae, the middle one larger and longer than the others. Total length, 0.8–0.9 mm.

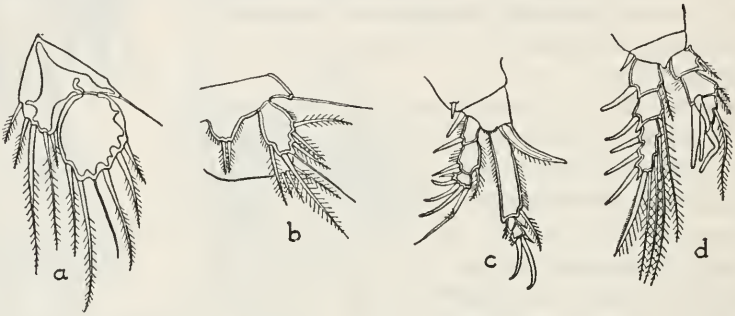

FIGURE 149.—*Amphiascus cinctus: a,* Female, fifth leg; *b,* male, fifth and sixth legs; *c,* male, first leg; *d,* male, second leg

Male.—First antennae geniculate, with two long aesthetasks; second basipod of first legs with a stout curved spine at the inner corner, reaching beyond the center of the basal endopod segment; second endopod nearly as long as exopod, with an apical spine, curved abruptly at the center, and two outer spines, the proximal one widened; distal segment of fifth leg oval, with six setae, the third inner one filiform, basal expansion reaching the middle of the distal segment with two apical setae; rudiments of sixth legs present. Total length, 0.7–0.8 mm.

Remarks.—The deep pink transverse band on the metasome retains its color in formalin and affords a ready means of identification. The species has never before been reported from our coasts. Brian published figures and descriptions of nauplius and metanauplius stages in Studi del Laboratorio Marino Genova, 1921 (pp. 87–88).

AMPHIASCUS SINUATUS Sars

FIGURE 150

Amphiascus sinuatus SARS, Crustacea of Norway, vol. 5, p. 178, pl. 118, 1906.

Occurrence.—A few specimens of both sexes were obtained in two of the brackish ponds on Chappaquiddick Island, July, 1925, and in Cuttyhunk Harbor.

Distribution.—Coast of Norway (Sars).

Color.—Body whitish and transparent, without pigment markings of any sort; eye deep ruby red.

Female.—Body rather slender; cephalic segment half the length of the metasome; rostrum very long and narrow, curved downward, and sharply pointed; urosome about as long and nearly as wide as metasome; genital segment with scarcely a trace of division; caudal rami quadrangular, wider than long, apical setae only slightly thickened at their bases; exopod of first legs a trifle shorter than the basal endopod segment, middle segment without an inside seta; distal segment of third exopod with three spines and three setae; distal segment of fifth legs elongate-ovate, pointed at the tip, with six setae, the second and third inner ones filiform; basal expansion narrow triangular, reaching beyond the center of the distal segment, with five setae, the four inner ones equal. Total length, 0.7–0.85 mm.

Male.—Second basipod of first legs with a long spine at the inner corner, reaching beyond the center of the basal endopod segment; second endopod as long as the exopod with a short apical spine and two long outer spines, reaching beyond the tip of the apical one; distal segment of fifth legs short, as wide as long, with five setae, the two terminal ones filiform, basal expansion reaching the tip of the distal segment, with two equal setae. Total length, 0.6–0.75 mm.

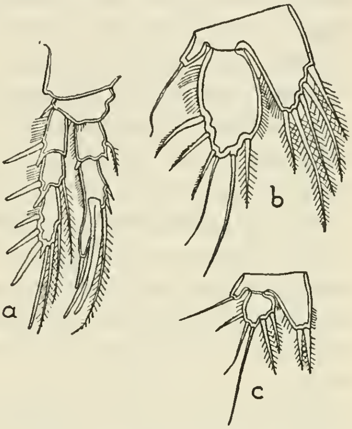

FIGURE 150.—*Amphiascus sinuatus:* *a,* Male, second leg; *b,* female, fifth leg; *c,* male, fifth leg

Remarks.—As Sars has pointed out, this species resembles *longirostris*, but it has a broad shallow sinus on the lateral margins of the cephalic segment at the anterior corner, and the first legs of the male are markedly different. The specimens from Cuttyhunk Harbor were living on the outside surface of compound ascidians on the piles of the wharf.

AMPHIASCUS DACTYLIFER, new species

PLATE 5, *a–h*

Occurrence.—Found in abundance in two of the brackish ponds on Chappaquiddick Island, July, 1926, and sparingly in Quisset Pond, Falmouth, August, 1927. The male holotype is U. S. N. M. No. 63425.

Color.—Urosome transparent, with a bluish tinge, metasome whitish and more opaque; mouth parts and swimming legs with a brownish wash; eggs white and opaque; eye pale blue.

Female.—Body narrow-elongate, nearly the same width throughout and five times as long as wide; head completely fused with the first segment, the resultant cephalothorax a little less than half the length of the metasome; second segment a little longer than any of the three following segments, which are about equal.

Urosome two-thirds as long as metasome; genital segment distinctly divided, the posterior portion longer than the anterior. Nearly every female carries a single spermatophore attached to the ventral surface of the anterior portion of the genital segment. This spermatophore is cylindrical and is coiled into a circle, and both ends are attached to the segment, reminding one somewhat of a spare tire. Abdomen made up of three segments, diminishing slightly in length and width posteriorly. Caudal rami nearly twice as wide as long, the outer apical seta considerably longer than the inner.

First antennae 8-segmented and evenly divided between the basal and terminal portions; second antennae of the usual pattern, with a 3-segmented exopod. Rostrum long and narrow and rather bluntly pointed, with a distinct ventral keel. In the first legs the basal segment of the endopod is only a little longer than the entire exopod, and carries a large plumose seta on its inner margin near the distal end. The two distal segments combined are two-thirds as long as the basal segment, and the third one is three times as long as the second, and tipped with two subequal setae. The spine at the inner corner of the second basipod is more than one-third the length of the basal endopod segment. The three exopod segments are about equal in length, the two basal ones each carry a long spine on the outer margin, the end segment carries two long spines at its outer distal corner and two apical setae, slightly geniculate. The three following pairs of legs are of the usual pattern in this genus; distal segments of third exopod with four spines and two setae. Inner expansion of basal segment of fifth legs broadly triangular, with two unequal apical, and three inner setae, all the latter plumose. Distal segment elongate oval, narrowed at its tip, with six setae, the second and third inner ones filiform and elongated. Total length, 0.75–0.85 mm.

Male.—Somewhat smaller than the female but otherwise of the same appearance. First antennae geniculate, the fourth segment considerably swollen and armed with an aesthetask as long as the four basal segments combined; the terminal portion of four segments is usually coiled into a small circle, with the terminal segment below the fifth segment. In the first legs the second basipod is armed on its inner margin with three wide, acute spines, short and black; between the distal one of these spines and the basal endopod segment is a fourth spine, much longer, bluntly pointed, minutely denticulate along its outer margin, and light colored. In the second legs the two basal exopod segments are much produced at the distal corners, and carry an outer fringe of coarse spinules; the apical spine of the end segment is acuminate at its tip and pectinate along its outer margin. The endopod is much shorter than the exopod and is tipped with a long apical spine, enlarged at its distal end and divided into a blunt thumb and two curved fingers, whence the specific name. There are also two outer spines, the proximal one much wider and laminate at its base. In the fifth legs the distal segment is as wide as long, narrowed at its tip, with a single apical filiform seta, a short spine on the outer margin, two unequal plumose setae and two minute spines on the inner margin. The two basal expansions are fused for half their length on the midline; the free portion is narrow, squarely truncated at the tip and armed with two coarse plumose setae. Total length, 0.7–0.8 mm.

Remarks.—The female can be identified by the structure of the first and fifth legs and by the curious spermatophore on the ventral surface of the genital segment; the fifth legs and the endopod of the second legs are the best characters in the male.

AMPHIASCUS HISPIDUS (Brady)

FIGURE 151

Stenhelia hispida BRADY, A monograph of the free and semiparasitic Copepoda of the British Islands, vol. 2, p. 32, pl. 42, figs. 1–14, 1880.

Amphiascus hispidus SARS, Crustacea of Norway, vol. 5, p. 166, pls. 107, 108, 1906.

Occurrence.—Found among algae in the Eel Pond, Woods Hole, June, 1925; in Penzance Pond, Woods Hole, August, 1925; in Poucha Pond, Chappaquiddick Island, and Katama Bay, Marthas Vineyard, July, 1925.

Distribution.—British Isles (Brady); Norwegian coast (Sars).

Color.—Body yellowish gray, the bases of the antennae, the mouth parts, the swimming legs, and the caudal rami darkened almost to black; eye dull red.

Female.—Body nearly five times as long as wide; cephalic segment considerably shorter than the rest of the metasome; urosome nearly as long as metasome; genital segment distinctly divided, and, with the first two abdominal segments, armed laterally with an oblique row of spinules near the posterior margin; caudal rami distinctly longer than wide, the outer apical seta swollen at its base.

First antennae 8-segmented, the two basal segments enlarged; exopod of first legs longer than the basal endopod segment, middle segment without an inner seta; end segment of third exopod with four spines and two setae; distal segment of fifth legs oval and rather pointed, with five setae, the middle (terminal) one filiform, basal expansion nearly reaching the center of the distal segment, with five plumose setae, the middle one the longest. Total length, 1–1.2 mm.

Male.—The first antennae are geniculate, the fourth segment considerably swollen and bearing a very long aesthetask; second basipod of first legs with a small knob on the inner margin, and at the distal corner a laminate process squarely truncated at its tip; and inside of this a short, stout spine; distal segment of second endopod with a small knob on its inner margin and a stout bayonet-shaped apical spine, the base of which is swollen into an inner knob; inside of this apical spine and parallel with it is a second spine of equal length but more slender. Distal segment of fifth legs as wide as long, with five setae, the two inner ones plumose and widely separated, the middle one terminal and filiform, the two outer ones short and spinelike; inner expansion very short, with 2 or 3 unequal setae and numerous spinules. Total length, 0.75–1 mm.

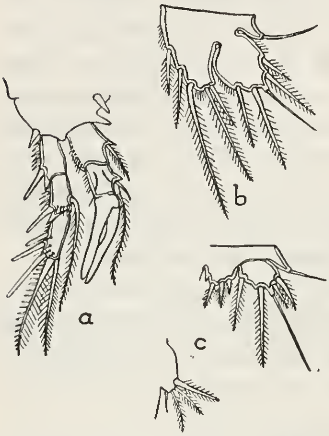

Figure 151.—*Amphiascus hispidus*: *a*, Male, second leg; *b*, female, fifth leg; *c*, male, fifth and sixth legs

Remarks.—The characters most easily observed are the caudal rami, longer than wide, and the outer apical seta swollen at its base. The distal segment of the fifth legs in both sexes has but five setae, the middle one alone apical and filiform. The species has not before been reported from our coasts.

AMPHIASCUS INTERMEDIUS (T. Scott)

Figure 152

Stenhelia intermedia T. Scott, 15th Ann. Rep. Fishery Board Scotland, pt. 3, p. 169, pl. 2, figs. 10–21, 1897.

Amphiascus intermedius Sars, Crustacea of Norway, vol. 5, p. 169, pl. 110, 1906.

Occurrence.—Nine females were obtained from Quisset Pond, Falmouth, July, 1926.

Distribution.—Scottish seas (T. Scott); Norwegian coast (Sars).

Color.—Body a uniform yellowish gray and fairly transparent; eggs white and opaque; eye bright red.

Female.—Body short and stout, not more than three times as long as wide; cephalic segment broad and evenly rounded anteriorly; rostrum bifid at its tip; urosome one-fourth shorter than metasome;

genital segment divided only laterally; caudal rami twice as wide as long, inner apical seta moderately thickened at its base.

First antennae 8-segmented, two basal segments swollen, end segment as long as the three preceding segments combined; first exopod nearly as long as entire endopod, without any inner setae; end segment of third exopod with four spines and two setae; distal segment of fifth legs oval, considerably tapered distally, with five setae, the middle one alone apical and filiform; basal expansion triangular, nearly reaching the tip of the distal segment, with five setae, all except the inner one sparsely plumose. Total length, 0.7–0.8 mm.

Male.—Second basipod of first leg with a broad tenonlike spine, rounded at its tip, on the inner margin; end segment of second endopod with an inner fingerlike process, two stout outer teeth, a wide bayonet-shaped apical spine, and a more slender inner spine, widened and bidfid at its tip.

Remarks.—The species may be recognized by the notch at the tip of the rostrum, and by the structure of the first and fifth legs. It has never before been reported from American coasts.

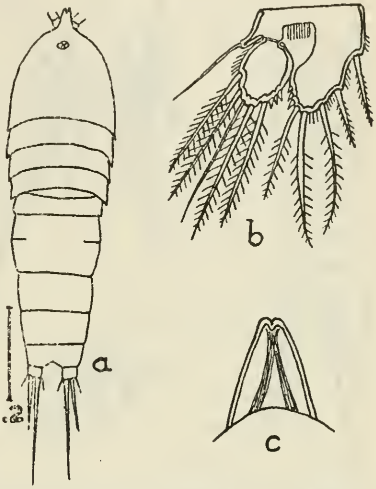

FIGURE 152.—*Amphiascus intermedius:* *a*, Female, dorsal (after Sars); *b*, female, fifth leg; *c*, rostrum

AMPHIASCUS COMMENSALIS Seiwell

FIGURE 153

Amphiascus commensalis SEIWELL, Proc. U. S. Nat. Mus., vol. 73, art. 18, p. 2, pl. 1, 1928.

Occurrence.—Both sexes were taken from the common sea pork, *Amaroucium*, collected near Woods Hole.

Distribution.—Not found outside the present area.

Color.—Body a uniform yellowish gray without other pigmentation.

Female.—Body slender, the metasome scarcely wider than the urosome; cephalic segment as long as the rest of the metasome; rostrum lanceolate; urosome as long as metasome; caudal rami shorter than anal segment, with short setae. Basal segment of first antenna much the longest; exopod of second antenna 2-segmented with four setae, attached to side of basal segment of endopod. Inner expansion of basal segment of fifth leg narrow, not reaching center of distal segment, with five setae, the middle one longest; distal segment about as wide as long, with five setae, the second inner one longest. Total length, 0.74 mm.

Male.—Body shorter than that of female, relatively as wide. First antennae not geniculate, fourth segment as long as first, second a little shorter, third only half the length. Both rami of first leg 3-segmented, the endopod a little longer than the exopod; endopod of second leg also longer than exopod, its end segment transformed into a stout spine. Fifth legs smaller than in the female, the inner expansion of the basal segment with but two setae. Total length, 0.65 mm.

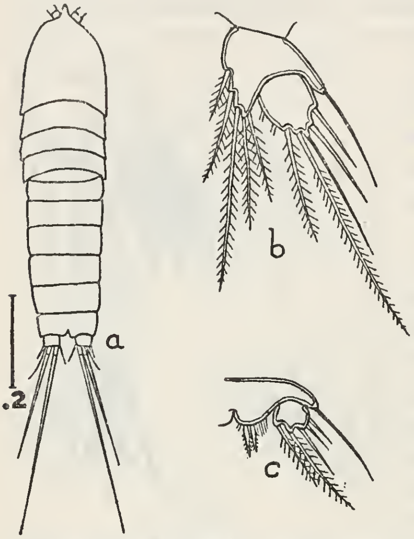

FIGURE 153.—*Amphiascus commensalis: a*, Female, dorsal (after Seiwell) ; *b*, female, fifth leg; *c*, male, fifth leg

Remarks.—Most of the species of this genus hitherto described have been taken from among algae and hydroids or close to the bottom mud. We can understand, therefore, how the present species has become commensal within an ascidian. As it is the only one with such a habitat, that fact alone is sufficient to distinguish it.

Genus STENHELIA Boeck, 1864

Body more or less pyriform; head fused with the first segment and much swollen; rostrum rigid, broadly triangular, and indented on either side near the tip; urosome short and usually tapered posteriorly; genital segment more or less divided; caudal rami longer than wide. First antennae 8-segmented, geniculate in the male; exopod of second antennae 3-segmented, the middle segment very short; mandibular palp biramose; maxillipeds unguiculate; rami of first four pairs of legs 3-segmented, except the first endopod, which is sometimes 2-segmented; fifth legs 2-segmented, the distal segment extended laterally and visible in dorsal view; two ovisacs, more or less divergent.

KEY TO THE SPECIES (FEMALES)

1. Distal segment of fifth leg as wide as long, with 6 setae, basal expansion with 4 setae________________ **arenicola, new species** (p. 229)
Distal segment of fifth leg longer than wide, with 5 setae, basal expansion with 5 setae____________________________ **reflexa** (p. 230)

STENHELIA ARENICOLA, new species

PLATE 6

Occurrence.—Four females were washed from the sand on Buzzards Bay bathing beach July, 1927 (female holotype, U.S.N.M. No. 63426); 2 females from the sand of Nobska bathing beach, east of the lighthouse, July, 1927.

Color.—Body transparent and without pigment markings.

Female.—Body short and stout, three times as long as wide; cephalic segment longer and wider than the rest of the metasome; free segments very short and diminishing regularly in width, the fifth segment but little narrower than the fourth. Urosome three-fifths as long as metasome, not tapered posteriorly but slightly widened; genital segment not divided, as wide as the fifth segment anteriorly but narrowed posteriorly. Basal abdominal segment longer than either of the other two and narrower; caudal rami widely separated and slightly divergent, twice as long as wide, the inner apical seta longer than the urosome, the outer one half as long. Rostrum well defined at its base, narrowed through the middle and notched at its tip. First antennae 8-segmented, the segments well defined and densely setiferous, the terminal segment longer than the two preceding it combined. Distal segment of exopod of second antenna slightly longer than the proximal segment and four times as long as the middle segment. Chewing blade of the mandible short and very irregularly toothed; basal part of palp narrowed in the center, the inner ramus no longer than the outer and abruptly reflexed,[7] with one of the terminal setae elongate and flagelliform; maxillae and maxillipeds as in other species of the genus.

Endopod of first leg scarcely reaching the end of the second exopod segment, its terminal segment as wide as long, the middle apical seta stout and greatly elongated; the proximal segment is hairy on its anterior surface. The three segments of the first exopod are about equal in length, the middle one with a short inner seta, the distal one with two slender outer spines and two unequal apical setae. The rami of the second and third legs are about equal in length, the endopod of the fourth legs is much shorter than the exopod. In the fifth legs the distal segment is as wide as long and narrowed at its base, with six setae, the second and third inner ones filiform, the third one very short. The basal expansion is rapidly attenuated inwardly and does not reach the midline; it is armed with four slender setae, the two middle ones longer than the others. Total length, 0.55–0.65 mm.

Remarks.—The species can be recognized by the increase in width of the posterior part of the urosome, by the wide separation of the caudal rami, and by the details of the fifth legs. It evidently sticks rather closely to the beach sands, since no specimens have been obtained elsewhere.

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[7] The inner ramus shown in Plate 6, *c*, was straightened under pressure.

STENHELIA REFLEXA (Brady)

Figure 154

Delavalia reflexa, Brady, A monograph of the free and semiparasitic Copepoda of the British Islands, vol. 2, p. 45, pl. 51, figs. 1–8, 11, 13, 1880.
Stenhelia reflexa Sars, Crustacea of Norway, vol. 5, p. 186, pl. 123, 1906.

Occurrence.—Ten specimens, including both sexes, were washed out of sand dredged at a depth of 23 fathoms, 12 miles south of No Mans Land.

Distribution.—British Isles (Brady); Norwegian fiords (Sars).

Color.—Body semitransparent and a uniform pale yellow, without pigment markings; eye bright red.

Female.—Body short and stout; rostrum broadly triangular at its base, tongue-shaped at the tip; urosome nearly as long as the metasome and tapered posteriorly; genital segment partly divided and conspicuously dilated anteriorly; caudal rami as long as anal segment, twice as long as wide. Rami of first legs equal in length, the endopod 2-segmented, each segment with an inner seta; the middle segment of the exopod has an inner seta, the end segment has three outer spines and two apical setae; distal segment of fifth legs spatulate, considerably narrowed at its base, with five setae, the second and third inner ones filiform, the third one very rudimentary; basal expansion broadly rounded, with five elongate stout setae, the outer one smaller than the others. Total length, 0.45–0.55 mm.

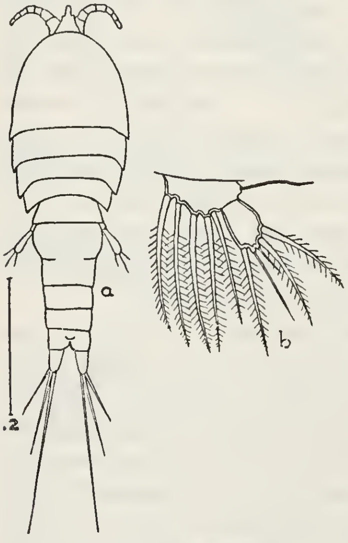

Figure 154.—*Stenhelia reflexa: a,* Female, dorsal; *b,* male, fifth leg

Male.—Smaller than female and more slender; second endopod 2-segmented, the distal segment longer and narrower than the proximal, with a short, denticulated, spinelike process at the tip and four unequal setae on the inner margin; fifth legs much reduced in size, the distal segment not separated at its base, but fused with the basal segment and armed with four setae, the second outer one terminal and filiform; basal expansion conical, as long as the distal segment and tipped with a single seta; the sixth legs are represented by a pair of plates on the ventral surface of the genital segment, each armed with three setae. Total length, 0.35–0.45 mm.

Remarks.—This species may be distinguished by the shape of the rostrum and the structure of the first and fifth legs. It is evidently a bottom species living in or on the sand, and it has never before been reported from this side of the Atlantic.

Family CANTHOCAMPTIDAE

Genus CANTHOCAMPTUS Westwood, 1836

Body slender and cylindrical, metasome only a little wider than the urosome; head fused with the first segment; rostrum rudimentary; urosome 4-segmented in female, 5-segmented in male, the segments fringed with spinules along their posterior margins; caudal rami somewhat longer than wide. First antennae 8-segmented; exopod of second antenna 2-segmented; rami of first four pairs of legs 3-segmented, except the fourth endopod, which is 2-segmented; all the endopods or those of the first two pairs of legs transformed in the male; fifth legs 2-segmented, distal segments rather small.

KEY TO THE SPECIES (FEMALES)

1. Anal operculum armed with 5 or 6 simple serrate spines; basal expansion of fifth legs not reaching center of distal segment -- **staphylinoides** (p. 231)
   Anal operculum armed with 10 or 12 spinules bifid at the tip; basal expansion reaching tip of distal segment --------- **minutus** (p. 232)

CANTHOCAMPTUS STAPHYLINOIDES Pearse

FIGURE 155

Canthocamptus staphylinoides PEARSE, Studies Zool. Lab. Univ. Nebraska, no. 65, p. 151, pl. 15, figs. 14–21, 1905.

Occurrence.—Fifteen specimens, including both sexes, were obtained from wet moss along the shores of Jenkins Pond, Falmouth, July, 1927.

Distribution.—Eastern Nebraska and Nantucket Island (Pearse).

Color.—Body yellowish green, inclined to reddish in the male; eggs and ovisac pale green; eye bright red.

Female.—Moderately slender; cephalic segment shorter than the rest of the metasome; urosome nearly as wide as metasome, its segments fringed with long spinules on their posterior margins on the ventral and lateral surfaces; genital segment only partially divided; anal operculum armed on its posterior margin with five or six stout serrate spines, which are as wide as long. Aesthetask on fourth segment of first antenna not reaching the end segment; exopod of first legs about the same length as the basal endopod segment; distal segment of fifth legs three-fourths as wide as long, with five setae, the second inner one enlarged and greatly elongated; the inner margin also carries two short spines; basal expansion triangular, with six setae, the second outer one very small. Total length, 1–1.15 mm.

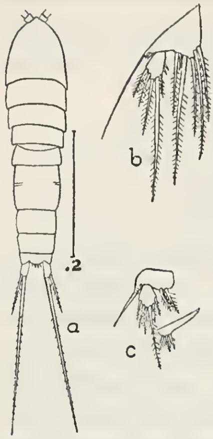

Figure 155.—*Canthocamptus staphylinoides; a*, Female, dorsal (after Pearse); *b*, female, fifth leg; *c*, male, fifth leg

Male.—Fourth and fifth segments of first antennae considerably enlarged; aesthetask on fourth segment just reaching base of end segment; inner process on middle segment of third endopod slender, acuminate, and slightly curved, reaching one-third of its length beyond the tip of the end segment, the latter with two apical setae, the outer one twice the length of the entire ramus; end segment of fourth endopod with a stout spine and two unequal filiform setae at its apex, two shorter filiform setae on its outer margin and three minute spines on its inner margin; distal segment of fifth legs small, with six setae, basal expansion much reduced, with two unequal setae; rudiments of sixth legs present. Total length, 0.9–1 mm.

Remarks.—Pearse established this species upon material obtained in Nebraska and afterward reported it from Nantucket.

CANTHOCAMPTUS MINUTUS Claus

Figure 156

Canthocamptus minutus Claus, Die frei lebenden Copepoden, p. 122, pls. 12, 13, 1863.—Sars, Crustacea of Norway, vol. 5, p. 197, pl. 128, 1906.

Occurrence.—Fifty specimens, including both sexes, were found in wet moss on the shore of Jenkins Pond, Falmouth, July, 1927.

Distribution.—Sweden (Lilljeborg); Germany (Claus); Holland (van Breemen); British Isles (T. Scott); United States (Herrick); everywhere in the northern continents (Marsh).

Color.—Body semitransparent with a faint bluish tinge, becoming white in formalin; a few scattered red oil globules; eggs and oviducts white; eye red.

Female.—Body sublinear, four and one-half times as long as wide; cephalic segment wider but not quite so long as the rest of the metasome; urosome shorter than metasome and considerably tapered; genital segment completely divided; anal segment evenly rounded posteriorly; anal operculum fringed on its posterior margin with about 12 spinules bifid at their tips and several times longer than wide; caudal rami shorter than anal segment, swollen through the middle, the outer margin convex with two stiff spines and three short spinules, the distal end obliquely truncated. First antennae scarcely reaching the center of the cephalic segment; exopod of first legs nearly as long as endopod; endopod of fourth leg scarcely reaching the tip of the basal exopod segment; distal segment of fifth leg twice as long as wide, with five setae, the terminal one much longer than the others; basal expansion nearly reaching the tip of the distal segment, with six very unequal setae. Total length, 0.5–0.6 mm.

Male.—Smaller than the female, with the same proportions; genital segment completely divided; the two distal segments of the second endopod fused into a single cone, with one apical and two inner setae; inner process on middle segment of third endopod straight, acuminate, and twice the length of the terminal segment; distant segment of fifth legs as wide as long, with six setae, basal expansion much reduced and tipped with two subequal setae. Total length, 0.4–0.5 mm.

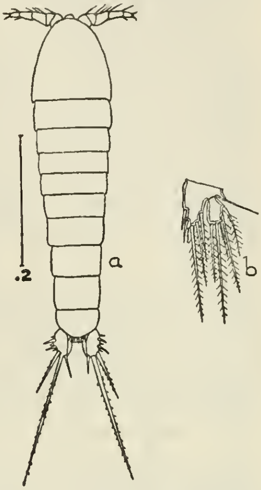

FIGURE 156.—*Canthocamptus minutus:* *a*, Male, dorsal; *b*, female, fifth leg

Remarks.—This species may be recognized by its small size and short first antennae, and it differs from all known species in the bifid tips of the spinules on the anal operculum. It lives in wet moss at or just above the water's edge and clings to the moss so tenaciously that it can be obtained only by picking it off with forceps under a binocular.

Genus ATTHEYELLA Brady, 1880

Body slender and cylindrical, metasome scarcely wider than urosome; head fused with the first segment and a little shorter than the rest of the metasome; urosome 4-segmented in female, 5-segmented in male, passing insensibly into metasome anteriorly, tapered posteriorly; caudal rami much longer than wide. First antennae 8-segmented, geniculate in the male; exopod of second antennae 1-segmented and minute; first legs subprehensile, exopod 3-segmented, endopod usually 2-segmented, but rarely 3-segmented; exopods of the three following pairs of legs 3-segmented, endopods 2-segmented, distal segment much longer than basal; third endopods transformed in male; fifth legs 2-segmented, of the usual pattern. One species found here.

ATTHEYELLA BICOLOR, new species

PLATE 7

Occurrence.—Found in abundance in two of the brackish ponds on Chappaquiddick Island, July, 1925. Type of the new species, U.S.N.M. No. 59763.

Color.—Body transparent, cephalic segment white, the rest of the body pale blue; ovary and oviducts light brown; contents of the midgut orange-red; eye bright ruby red.

Female.—General form short and stout, tapering regularly backward without any demarcation between metasome and urosome; cephalic segment broadly rounded anteriorly and wider than any of the other segments; rostrum prominent, poorly defined at its base and obtuse at its tip. Second (first free) metasome segment longer than any of the others; urosome three-fifths as long as metasome, its segments fringed laterally and ventrally with small spinules; genital segment distinctly divided, abdominal segments diminishing in length and width backward; caudal rami one-half longer than wide, their inner margins slightly convex and armed with many spines and setae; both apical setae jointed near their base, the inner one longer than the urosome. The anal operculum and the corners of the anal segment are densely fringed with coarse spinules.

First antennae 8-segmented and rather stout, especially the two basal segments; they are only half the length of the cephalic segment and sparsely setose; the second segment carries four setae on its dorsal surface and three on the anterior margin; the aesthetask on the fourth segment reaches beyond the tip of the antenna. The second antennae have a 1-segmented exopod attached to the side of the basal endopod segment, and armed with three setae. The two segments of the maxilliped are the same length, the distal one convex on its inner margin and fringed with long hairs, the terminal claw as long as the second segment and slightly curved.

Rami of first legs equal, exopod 3-segmented, endopod 2-segmented, proximal segment of latter twice as wide and half as long as distal segment; this endopod is tipped with two setae, the inner one longer than the outer. In the second and third legs the endopods are a little longer than the basal exopod segments, in the fourth legs they scarcely reach the center of that segment. In the second and third legs the distal endopod segment is four times as long as the basal, with three apical setae, the middle one much the longest. In the fourth legs the distal segment is less than three times as long as the basal, with two apical setae, the outer one five times as long as the inner. In the fifth legs the distal segment is as wide as long, with five setae, two apical and three outer, an apical seta the longest. The basal expansion extends half its length beyond the tip of the distal segment and is armed with six setae, the second outer one much elongated. Total length, 0.55–0.65 mm.

Male.—Smaller and more slender than the female; the first antennae are geniculate, the first segment beyond the hinge considerably enlarged, the end segment curved into a sort of claw. The outer spines of the exopods of the swimming legs are lengthened and widened and bluntly pointed. The first endopod is a little longer than the exopod, the second endopod has a short stout spine at the outer distal corner of the end segment, the third endopod is 3-segmented, the basal segment very short, the middle segment with a row of short hairs across its surface and a curved spine on its inner margin, the end segment is spherical, with two unequal apical setae, the fourth endopod is like that of the female.

The fifth legs are much smaller than in the female; the distal segment reaches the tip of the basal expansion, is truncated and armed with three setae, the middle one the longest, and small spinules on the lateral margins. The basal expansion is broadly rounded with three apical setae and two spinules on each lateral margin. Total length, 0.4–0.5 mm.

Remarks.—This species may be told by the structure of the fifth legs in the female and by the endopod of the third legs in the male. It was quite abundant in the two ponds mentioned above but was found nowhere else.

Genus MARSHIA Herrick, 1895

Body slender and cylindrical, metasome only slightly wider than the urosome; head fused with the first segment and much shorter than the rest of the metasome; urosome 4-segmented in female, 5-segmented in male; caudal rami much longer than wide, apical setae of moderate length. First antennae 6-segmented, third and fourth segments much enlarged in male, aesthetask on fourth segment extending beyond the tip of the antenna; exopod of second antenna wholly lacking; exopods of first 4 pairs of legs 3-segmented, endopods 2-segmented, the two segments of fourth endopod sometimes fused; fifth legs apparently 1-segmented, the two segments being completely fused, and the outer lobe of the basal segment often obsolete. One species found here.

MARSHIA BREVICAUDATA Herrick

FIGURE 157

Marshia brevicaudata HERRICK, Copepoda of Minnesota, p. 137, pl. 32, figs. 6–13, 1895.

Occurrence.—Five females and a male were obtained from the small lily pond south of Ashumet Pond, Falmouth, July, 1926; a single female from the south pond on Penikese Island, August, 1926.

Distribution.—New Mexico (Herrick, Marsh).

Color.—Transparent with a whitish cast and without pigment markings of any kind; eye invisible.

Female.—Cephalic segment much shorter but wider than the rest of the metasome; rostrum prominent and peglike; urosome half the length of the metasome, the segments of both divisions fringed posteriorly with spinules; genital segment not divided; caudal rami one-half longer than wide, the inner apical seta twice the length of the outer.

Rami of first legs about equal, the distal segment of the endopod one-fourth longer than the basal, with a slender apical spine much longer than the segment and sparsely denticulate. Inside of the spine and close to it are two plumose setae, the nearest one twice the length of the spine, the other only half that length. The outer spines of the exopod are rather blunt and stout, and each segment has two or three outer spinules. The fourth endopod is shorter than the basal exopod segment; in some specimens it showed two distinct segments, the distal one three times the length of the basal; in other specimens the two segments were completely fused without a trace of demarcation. This endopod has two apical setae, the outer one plumose and five times as long as the inner, which is filiform. In the fourth exopod the two apical setae and the inner seta of the middle segment are exceptionally long and stout, while the spines on the outer margins of all three segments are slender and weak. In the fifth legs the outer lobe of the basal segment is distinctly indicated and bears a long smooth seta; the inner expansion is quadrangular

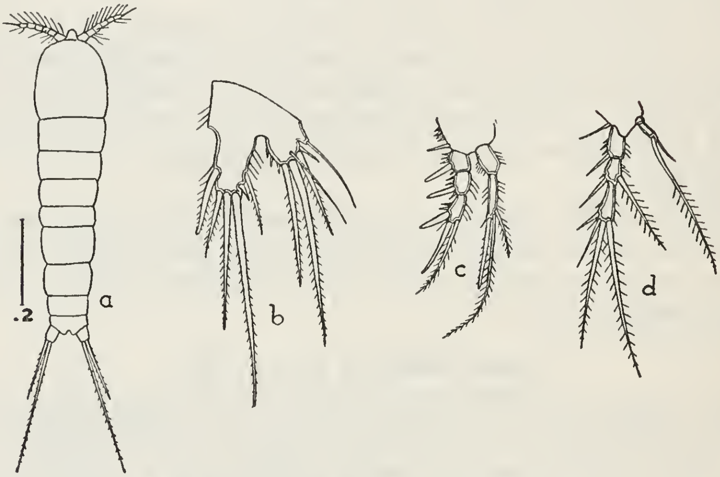

Figure 157.—*Marshia brevicaudata: a,* Female, dorsal; *b,* female, fifth leg; *c,* female, first leg; *d,* female, fourth leg

and squarely truncated at its tip, where it carries three stout setae, the outer one much the thickest and longest; there is also one stout seta on each lateral margin. The distal segment is as wide as long and obliquely truncated, with three stout setae on the oblique margin, the middle one much the longest, and a filiform seta on the anterior surface near the base of the long middle seta. Total length, 0.5–0.65 mm.

Male.—A little smaller than the female, with a more prominent rostrum; urosome 5-segmented and as long as the metasome; caudal rami twice as long as wide, with very long apical setae, which are entirely separated at their base. First antennae with the third segment considerably swollen and armed with a short and club-shaped aesthetask, the apical segment subspherical and tipped with two short claws. Second antennae, mouth parts, and swimming legs like those of the female; fifth legs smaller, the distal segment as long as the basal expansion, with four slender and weak setae, the basal expansion with three still smaller setae. Total length, 0.4–0.5 mm.

Remarks.—This is the first record of this species outside of New Mexico, where it was found in fresh and brackish waters. Herrick's diagnosis of his new genus *Marshia*, founded on this and another species, and his descriptions of the two species were filled with errors, especially with regard to the five pairs of legs. Endopods and exopods were transposed in every instance, and although the fifth legs show no visible segmentation, their form shows conclusively that they are composed of two segments fused. Marsh, in his Fresh-water Biology, 1918 (p. 780), corrected some of these statements, but no revised description has ever been published. For this reason a longer description has been given here, with figures of the female, since nearly all Herrick's figures of this species were from the male.

Genus MESOCHRA Boeck, 1865

Body of medium length, tapered posteriorly, with but little differentiation between metasome and urosome; head fused with the first segment and much shorter than the rest of the metasome; rostrum broadly triangular and bluntly rounded; urosome 4-segmented; genital segment with only lateral indications of division; caudal rami short and truncated. First antennae 6- or 7-segmented; exopod of second antennae 1-segmented, minute; exopods of first four pairs of legs 3-segmented, endopods 2-segmented, proximal segments well developed; first legs prehensile, the endopod longer than the exopod and often 3-segmented; fifth legs 2-segmented, of the usual pattern.

KEY TO THE SPECIES (BOTH SEXES)

1. First endopod 2-segmented; basal expansion of fifth legs longer than distal segment, with 6 setae in female, 3 in male_ **lilljeborgi** (p. 238)
   First endoped 3-segmented; basal expansion of fifth legs as long as distal segment, with 5 setae in female, 2 in male____ **pygmaea** (p. 239)

MESOCHRA LILLJEBORGI Boeck

FIGURE 158

Mesochra lilljeborgi BOECK, Forh. Vid.-Selsk. Christiania, 1864, p. 275.—SARS, Crustacea of Norway, vol. 5, p. 208, pl. 135, 1906.

Occurrence.—Both sexes found in moderate numbers in one of the brackish ponds on Chappaquiddick Island, and in Quisset Pond, Falmouth, July, 1926.

Distribution.—Coast of Sweden (Lilljeborg); British Isles (Brady); Kiel Bay (Giesbrecht); coast of France (Canu); Nova Zembla (T. Scott); coast of Norway (Boeck, Sars); Adriatic (Car, Pesta).

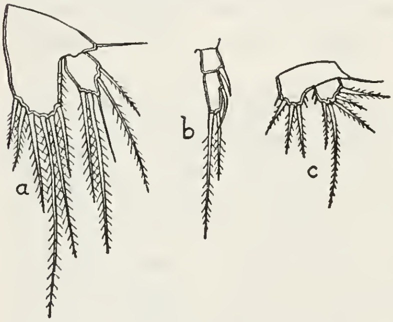

FIGURE 158.—*Mesochra lilljeborgi: a,* Female, fifth leg; *b,* male, endopod of third leg; *c,* male, fifth leg

Color.—Body transparent with a whitish tinge; ovary and oviducts bluish green; eye bright red.

Female.—Body about four times as long as wide; cephalic segment as long as the three following segments combined; urosome three-fifths as long as metasome, its segments fringed with spinules along their posterior margins; caudal rami nearly as wide as long. First antennae 7-segmented, shorter than the cephalic segment; exopod of second antennae linear; exopod of first legs shorter than basal endopod segment, the middle segment with an inner seta; basal segment of first endopod sometimes with two inner setae. Distal segment of fifth legs rounded-oval, with five setae, the middle terminal one filiform; basal expansion tongue-shaped, reaching far beyond the tip of the distal segment, with six setae, the third outer one the longest. Total length, 0.6–0.7 mm.

Male.—The four basal segments of the first antennae much enlarged and densely setose, the three distal segments curved like a claw; distal segment of third endopod with two unequal apical setae and a curved inner spine; fifth legs much smaller than those of the female, the two segments often fused and about the same length, the distal segment with fifth setae, the basal expansion with three setae. Total length, 0.5–0.6 mm.

Remarks.—Sars designated this as a littoral form, often left in tide pools. It can be recognized by the 2-segmented endopod of the first legs and by the fifth legs of both sexes. It has never before been reported from American localities, but it is likely to be found in any of the brackish ponds of the present area.

MESOCHRA PYGMAEA (Claus)

Figure 159

Dactylopus pygmaeus Claus, Die frei lebenden Copepoden, p. 127, pl. 17, 1863.
Mesochra pygmaea Sars, Crustacea of Norway, vol. 5, p. 209, pl. 136, 1907.

Occurrence.—Seventy-five specimens, including both sexes, were washed from the sand on the shore of Katama Bay, Marthas Vineyard, August, 1927.

Distribution.—Helgoland (Claus); Scottish coast (T. Scott); Polar seas (T. Scott); Norwegian coast (Sars).

Color.—Body brownish or grayish yellow and only semitransparent; eggs dark cinnamon-brown; eye minute and reddish.

Female.—Body comparatively short and stout, tapered posteriorly, the metasome passing insensibly into the urosome; cephalic segment as long as the rest of the metasome and the widest part of the body; genital segment only laterally divided; caudal rami wider than long, both apical setae jointed near their base. First antennae 6-segmented, three terminal segments nearly as long as three basal; first endopod twice the length of the exopod, middle segment of latter without an inner seta; basal expansion of fifth legs narrow and just reaching the tip of the distal segment, with five setae, the second outer one very long; distal segment as wide as long, obliquely truncated, with five setae, the second inner one elongated. Total length, 0.35–0.4 mm.

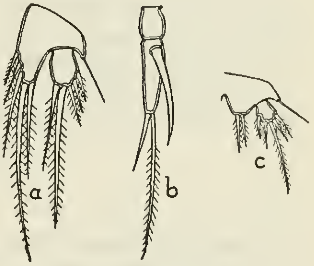

Figure 159.—*Mesochra pygmaea: a,* Female, fifth leg; *b,* male, endopod of third leg; *c,* male, fifth leg

Male.—Terminal segment of second endopod with a stout spine near the base and two unequal apical setae; basal expansion of fifth legs reaching little beyond the center of the distal segment, with two subequal setae; distal segment constricted at the base, with five setae, the middle one the longest, the two outer ones very weak. Total length, 0.33–0.38 mm.

Remarks.—This species is scarcely half the size of the preceding one; its integument is exceptionally hard and smooth, and this makes it difficult to dissect. The first endopods and the fifth legs are the best means of identification, coupled with its very small size. It is here reported for the first time from American coasts, and was fairly abundant in the one locality.

Genus NITOCRA Boeck, 1865

Body slender and cylindrical, with no sharp distinction between metasome and urosome; head fused with the first segment and shorter than the rest of the thorax; urosome two-thirds as long as metasome and 4-segmented, the segments coarsely spinulose along their posterior margins; genital segment divided in the middle; anal operculum with a denticulate margin; caudal rami short and covered with spines. First antennae 8-segmented, the two basal segments enlarged; endopod of second antenna 3-segmented, the 1-segmented exopod attached to the end of the basal segment; rami of first four pairs of legs 3-segmented, first legs prehensile; fifth legs 2-segmented, of the usual pattern; a single ovisac.

KEY TO THE SPECIES (BOTH SEXES)

1. Rami of first legs equal; 2 terminal segments of first endopod also equal, and together as long as basal segment______ spinipes (p. 240)
Endopod of first legs much longer than exopod__________________________ 2
2. The 2 terminal segments of first endopod equal, and together less than half as long as basal segment_____________________ typica (p. 241)
Apical segment of first endopod twice as long as second segment, two together longer than basal segment____ chelifera, new species (p. 242)

NITOCRA SPINIPES Boeck

FIGURE 160

Nitocra spinipes BOECK, Forh. Vid.-Selsk. Christiania, 1864, p. 274.—SARS, Crustacea of Norway, vol. 5, p. 213, pl. 139, 1907.

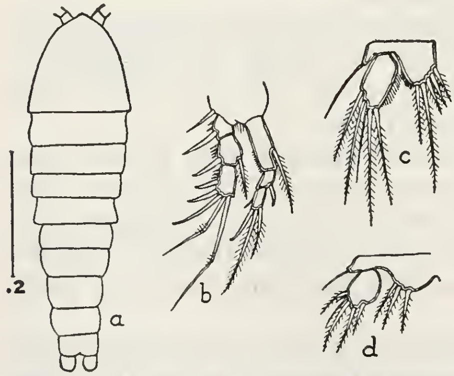

FIGURE 160.—*Nitocra spinipes: a,* Female, dorsal; *b,* female, first leg; *c,* female, fifth leg; *d,* male, fifth leg

Occurrence.—Found in abundance in one of the brackish ponds on Chappaquiddick Island, July, 1926; found sparingly in the French Watering Place on Naushon Island, and in Quisset Pond, Falmouth.

Distribution.—Scottish coast (T. Scott); Norwegian coast (Boeck, Sars); Adriatic (Carazzi, Pesta); Nova Zembla (Gurney); Baltic coast (van Douwe); coast of England (Gurney).

Color.—Female transparent, head whitish spotted with red, thorax and abdomen pale pinkish red, deepest in the fifth segment of the thorax and along the lateral margins of the segments in the abdomen; eye bright ruby red; eggs pale pink with bright red centers;

ovaries and oviducts deep red. In the male the head is whitish and the rest of the body a uniform pinkish red.

Female.—Body five times as long as wide; cephalic segment much shorter than the rest of the thorax; rostrum slender and pointed; urosome two-thirds as long as metasome; caudal rami much wider than long. Aesthetask on fourth segment of first antenna reaching half its length beyond the tip of the antenna; rami of first legs equal, basal endopod segment with a row of spinules on its outer margin distally; basal expansion of fifth legs reaching beyond center of distal segment, with five setae, the second outer one elongate; distal segment oval, with five setae, the middle one filiform. Total length, 0.7–0.8 mm.

Male.—First antennae 9-segmented and geniculate, the fourth, fifth, and sixth segments much enlarged and forming the hand of a chela, with the dactylus composed of the last three segments; aesthetask as long as in the female; none of the endopods of the swimming legs modified; fifth legs smaller than in the female, the distal segment broadly oval, with six setae, the first and fourth outer ones elongated, the second and third filiform, the second one almost obsolete; basal expansion scarcely reaching beyond the base of the distal segment, with three subequal setae. Total length, 0.6–0.7 mm.

Remarks.—This species may be distinguished by the structure of the first and fifth legs. It is a littoral form found in brackish water, but it lives also in fresh water, as shown by its occurrence in the French Watering Place. This is the first record of its presence in American waters.

NITOCRA TYPICA Boeck

FIGURE 161

Nitocra typica BOECK, Forh. Vid.-Selsk. Christiania, 1864, p. 274.—SARS, Crustacea of Norway, vol. 5, p. 212, pl. 138, 1907.

Occurrence.—Two females were washed from the sand on the surf beach of the southern shore of Marthas Vineyard, August, 1927.

Distribution.—British Isles (Brady); Kiel Bay (Giesbrecht); Dutch coast (van Breemen); French coast (Canu); Nova Zembla (T. Scott); Norwegian coast (Sars).

Color.—Body semitransparent and whitish, one of the females faintly tinged with blue; eye reddish, scarcely visible.

Female.—Body sublinear, metasome scarcely wider than the urosome; cephalic segment little more than one-third the length of the metasome; urosome three-fifths as long as metasome; genital segment with only faint indications of division; anal segment shorter than preceding segment and coarsely spinulose; anal operculum fringed with stout spines; caudal rami wider than long, apical setae jointed near their base. First antennae 8-segmented, densely setose;

exopod of second antenna enlarged distally, with three apical setae; basal endopod segment of first legs longer than the entire exopod, the two terminal segments short, equal, and together half as long as basal segment; the three following pairs of legs with a reduced number of setae on the distal segments of both rami; distal segment of fifth legs small oval, with six setae, the third inner one filiform, basal expansion reaching middle of distal segment, with five setae, the second outer one longest. Total length, 0.6–0.65 mm.

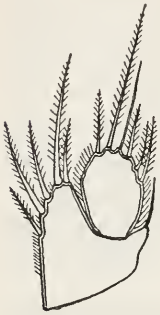

FIGURE 161.—*Nitocra typica*: Female, fifth leg

Male.—Unknown.

Remarks.—This species may be recognized by the spines on the anal segment and caudal rami and by the structure of the first and fifth legs. Sars said of it: "It is a strictly littoral species, found in more or less brackish water, and occasionally also in tidal pools." This is its first record from our American shores, but it is likely to be found in the sands of other beaches.

NITOCRA CHELIFER, new species

PLATE 8

Occurrence.—Fifty specimens, including both sexes, were washed from the sand on the shore of Katama Bay, Marthas Vineyard, August, 1927. The male holotype is U.S.N.M. No. 63427.

Color.—Body fairly transparent, of a whitish color but without any pigment markings; ovaries, oviducts, and eggs faintly tinged with blue; eye dull red.

Female.—Body elongate and narrow, five times as long as wide; metasome somewhat compressed and strongly arched dorsally, the movable joint between the fourth and fifth segments rather conspicuous; cephalic segment as long as the three following segments combined; rostrum narrow and short but well defined at its base. Urosome three-fourths as long as metasome; genital segment without a trace of division, about as long as the two basal segments of the abdomen combined, with slightly convex lateral margins. Abdomen 3-segmented, anal segment a little shorter than the penultimate segment, with two transverse rows of spinules on each lateral surface; anal operculum at about the center of the dorsal surface, fringed with slender spinules. Caudal rami wider than long, each with a transverse row of spinules across its dorsal surface; inner apical seta four-fifths as long as the whole body, outer one one-third as long, both jointed near the bases.

First antennae 8-segmented, longer than the cephalic segment, the aesthetask on the fourth segment longer than the entire antenna. The four terminal segments are less than half as long as the four basal; the fourth and eighth segments are well armed with setae, the others sparsely setose. The second antenna is tipped with six setae, five of which are geniculate, the basal segment is not divided and the 1-segmented exopod is attached to its side nearer the base and carries three apical setae. The maxillipeds are rather small and weak, the second segment fringed with minute hairs on its inner margin.

The first endopod is much longer than the exopod, its terminal segment is narrow and more than twice as long as the second segment; the spine on the second basipod over the base of the endopod is long, narrow, and acuminate. The three following pairs of legs are chiefly noticeable for the length of the apical setae at the tips of their rami, and the rudimentary condition of the other setae. The basal expansion of the fifth legs does not reach the center of the distal segment, is narrowed at its tip, and carries two apical and three inner setae, the inner apical seta more than twice the length of the others.

The distal segment is twice as long as wide and swollen through its center; it carries five apical setae and one on the outer margin at the center, and five or six spinules on the inner margin; the second inner apical seta is twice the length of any of the others. Total length, 0.45–0.55 mm.

Male.—Smaller than the female but with the same general proportions. First antennae stouter and 9-segmented; the second segment has a transverse row of setae across its dorsal surface near the distal end. The aesthetask on the fourth segment is fully as wide as the terminal segments and nearly as long as the whole antenna. As a result under low magnification the antenna appears bifurcate at the fourth segment. The first legs are stouter than those of the female; the two terminal segments of the endopod are about equal in length, and the two apical setae are geniculate. The spine on the second basipod over the base of the endopod is transformed into a stout club-shaped process, with a well-defined chela at its tip. This is evidently used as a prehensile organ and is more or less characteristic of the genus, corresponding spines of a different pattern being found in the species *hibernica* and *simplex*. The basal expansion of the fifth legs is shorter than in the female and is armed with five setae all about the same length; the distal segment has two subequal apical setae, two on the inner and two on the outer margin. Total length, 0.4–0.45 mm.

Remarks.—This new species may be recognized by the long apical setae on the caudal rami, by the structure of the first and fifth legs in the female, and by the curious prehensile organ on the basipod of the first leg in the male.

Genus AMEIRA Boeck, 1865

Body slender and somewhat compressed; head fused with the first segment and shorter than the rest of the metasome; rostrum almost obsolete; urosome 4-segmented, nearly as long as the metasome, its segments much less coarsely spinulose than in *Nitocra;* genital segment divided in the middle; caudal rami short and without spinules. First antennae 8-segmented; exopod of second antennae narrow and 1-segmented; rami of first four pairs of legs 3-segmented, none of the endopods modified in the male; first legs prehensile, the endopods much longer than the exopods; fifth legs 2-segmented of the usual pattern.

KEY TO THE SPECIES

FEMALES

1. Basal segment of first endopod longer than 2 distal segments combined; basal expansion of fifth legs with 4 setae ------------------ 2
   Basal segment of first endopod shorter than 2 distal segments combined; basal expansion of fifth legs with 5 setae ----- **simplex** (p. 244)
2. First antennae no longer than cephalic segment; basal segment of first endopod but little longer than 2 distal segments combined ------------------ **tau** (p. 245)
   First antennae much longer than cephalic segment; basal segment of first endopod twice as long as 2 distal segments combined ------------------ **tenuicornis** (p. 247)

MALES

1. Endopod of first legs much longer than exopod; basal expansion of fifth legs with 2 very unequal setae ------------------ 2
   Rami of first legs equal in length; basal expansion of fifth legs with 3 subequal setae ------------------ **simplex** (p. 244)
2. The 2 distal segments of first endopod equal in length; middle segment of first exopod with an inner seta ------------------ **tau** (p. 245)
   The 2 distal segments of first endopod very unequal in length; middle segment of first exopod without inner seta ---- **tenuicornis** (p. 247)

AMEIRA SIMPLEX Norman and T. Scott

FIGURE 162

Ameira simplex NORMAN and SCOTT, Ann. Mag. Nat. Hist., ser. 7, vol. 15, p. 291, 1906.—SARS, Crustacea of Norway, vol. 5, p. 219, pl. 144, 1907.

Occurrence.—Two females from one of the brackish ponds on Chappaquiddick Island, August, 1926; 15 males and females washed from the sand on the bathing beach at Dennis, north shore of Cape Cod.

Distribution.—British Isles (T. Scott); coast of Norway (Sars).

Color.—Body transparent with a whitish tinge and without pigment markings; becoming opaque white in formalin; no eye visible.

Female.—Metasome and urosome about the same length and not sharply differentiated; cephalic segment pointed anteriorly; anal segment as long as penultimate segment; caudal rami longer than wide and squarely truncated at the tips. Two basal segments of first antennae enlarged and together nearly as long as the rest of the appendage; basal segment of second antenna not divided, the exopod attached to its side near the center; distal segment of first endopod as long as basal segment, twice the length of the second segment; distal segment of fifth legs twice as long as wide, narrowed apically, with six setae, the outer apical one filiform; basal expansion reaching center of distal segment, with five setae, the second outer one twice the length of the others. Total length, 0.55–0.65 mm.

Male.—Smaller and more slender than the female; first antennae 9-segmented, geniculate, the terminal portion made up of three broad segments, the aesthetask as broad as these terminal segments and as long as the entire antenna. The rami of the first legs are equal; the basal endopod segment is slightly longer than the two distal segments, which are themselves equal in length; the middle exopod segment has an inner seta. The fifth legs are much reduced in size, the basal expansion scarcely reaches beyond the base of the distal segment and is armed with three equal setae; the distal segment is twice as long as wide, with six setae, the third outer one filiform. Total length, 0.5–0.6 mm.

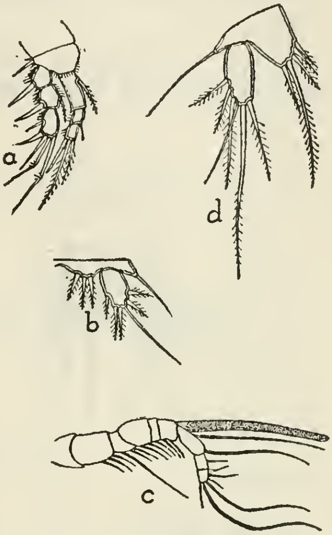

FIGURE 162.—*Ameira simplex: a,* Male, first leg; *b,* male, fifth leg; *c,* male, first antenna; *d,* female, fifth leg

Remarks.—This is a littoral form and has been found hitherto only on the Scottish and Norwegian coast. The short first antennae and the fifth legs in both sexes are the best distinguishing characters.

AMEIRA TAU (Giesbrecht)

FIGURE 163

Nitocra tau GIESBRECHT, Vierter Ber. Comm. wiss. Unters. deutsch. Meere, Jahrg. 7, p. 117, pl. 1, figs. 9, 13, pl. 3, fig. 13, pl. 4, figs. 2, 11, 29, 1882.
Ameira tau SARS, Crustacea of Norway, vol. 5, p. 218, pl. 143, 1907.

Occurrence.—Found in small numbers in one of the brackish ponds on Chappaquiddick Island, August, 1925; washed in great abundance from the sand of Buzzards Bay bathing beach at Woods Hole, July, 1927; washed also from the sand of Nobska bathing beach, and from sand on the shore of Katama Bay, Marthas Vineyard.

Distribution.—Scottish tide pools (T. Scott); Kiel Bay (Giesbrecht); coast of Norway (Sars); Adriatic (Pesta).

Color.—Body transparent with a whitish tinge, becoming snow white and opaque in formalin; eggs gray or grayish white; eye not visible.

Female.—Cephalic segment short and broadly rounded anteriorly; anal segment not more than half the length of the penultimate segment; caudal rami wider than long, somewhat obliquely truncated at the tips. Two basal segments of first antennae enlarged, but together only half as long as the rest of the appendage; basal segment of second antenna distinctly divided, the exopod attached at the joint; distal segment of first endopod three times as long as second segment and half as long as the basal segment; middle segment of first exopod without an inner seta; distal segment of fifth legs strongly contracted at its base, broadly rounded at its tip, with five setae, the second inner one filiform and greatly elongated; basal expansion reaching beyond the center of the distal segment, with four setae, the two outer ones sparsely plumose, the two inner ones with tufts of cilia at their tips, the second outer one the longest. Total length, 0.45–0.55 mm.

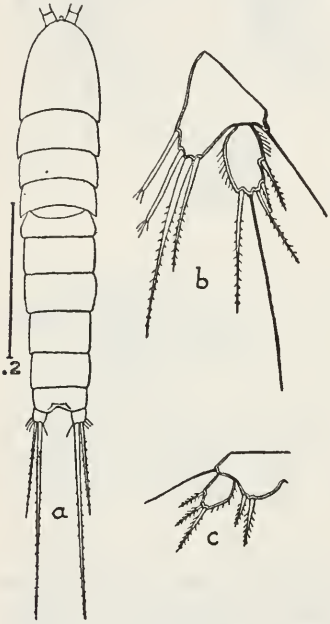

FIGURE 163.—*Ameira tau: a,* Female, dorsal (after Sars); *b,* female, fifth leg; *c,* male, fifth leg

Male.—First antennae 9-segmented, the fourth, fifth, and sixth segments moderately swollen and more or less fused, aesthetask reaching little beyond the tip of the end segment. Endopod of first legs much longer than exopod, its two distal segments about equal in length and together about half the length of the basal segment; middle segment of first exopod with an inner seta. Fifth legs much reduced in size, the distal segment oval, one-half longer than wide, with three setae, of which two are apical and one outer; basal expansion nearly reaching the center of the distal segment, with two very unequal setae. Total length, 0.4–0.5 mm.

Remarks.—This minute species lives in the sand and among algae and swims about freely only when disturbed. It can be recognized most easily by the structure of the first and fifth legs. It has not before been reported outside of the two localities mentioned above, but is likely to be found in the beach sands anywhere within the present area.

AMEIRA TENUICORNIS T. Scott

FIGURE 164

Ameira tenuicornis T. SCOTT, 20th Ann. Rep. Fishery Board Scotland, pt. 3, p. 459, pl. 24, 1902.—SARS, Crustacea of Norway, vol. 5, p. 397, suppl. pl. 27, 1911.

Occurrence.—A dozen specimens, including both sexes, were washed out of the sand on the shore of Katama Bay, Marthas Vineyard, August, 1927.

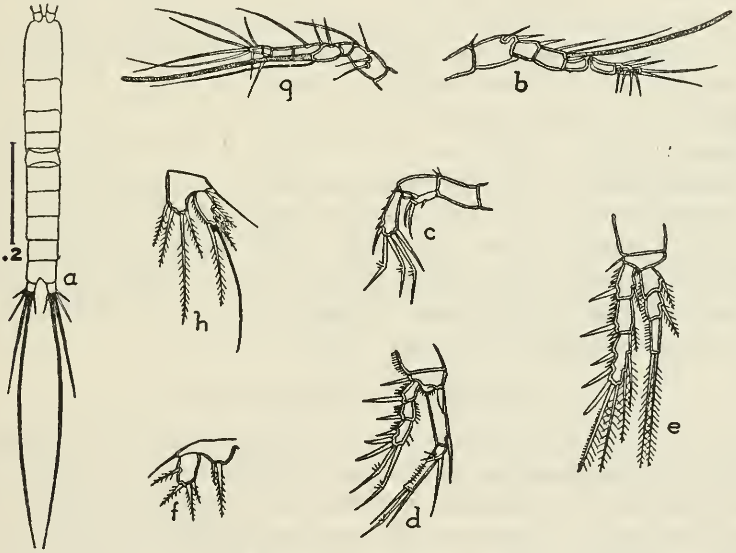

FIGURE 164.—*Ameira tenuicornis: a,* Male, dorsal; *b,* male, first antenna; *c,* male, second antenna; *d,* male, first leg; *e,* male, second leg; *f,* male, fifth leg; *g,* female, first antenna; *h,* female, fifth leg

Distribution.—Scottish coast (T. Scott); Norwegian coast (Sars).

Color.—Body transparent and whitish, without pigment markings; eye reddish.

Female.—Body slender, six times as long as wide, the metasome scarcely wider than the urosome, the two of equal length; rostrum minute and blunt; anal segment shorter than the penultimate segment; caudal rami one-half longer than wide, inner apical seta longer than the entire body, the two curved like parentheses. First antennae reaching the fourth thoracic segment, aesthetask nearly as long as the whole antenna; exopod of second antenna 2-segmented, distal segment very short; end segment of first endopod twice as long as middle segment, the two combined half the length of the basal segment; rami of three following pairs of legs with long apical setae; basal expansion of fifth legs obtusely rounded, reaching the middle of the distal segment, with four setae, the second outer one the longest; distal segment oval, twice as long as wide, with five very unequal setae, the second inner one filiform and much elongated. Total length, 0.6–0.7 mm.

Male.—Smaller than the female, seven times as long as wide; first antennae stouter and not so long, 8-segmented, the aesthetask longer than the entire antenna. In the first legs the end segment of the endopod is twice as long as the middle segment, but the two combined are as long as the basal segment; the middle segment of the first exopod is without a seta. The basal expansion of the fifth legs does not reach the center of the distal segment and is armed with two very unequal setae; the distal segment is somewhat quadrangular, with three apical setae and one on the outer margin at the center, all four short. Total length, 0.45–0.55 mm.

Remarks.—This is the first record of the species outside of Scotland and Norway. It may be recognized by its slender form and the exceptionally long caudal setae, as well as by the first and fifth legs. It is worthy of note that both Scott and Sars obtained their specimens from submarine banks of sand, but at considerable depths. From the location of the present specimens it is evident that they also come into shallow water near shore.

PARALEPTASTACUS, new genus

Body slender and cylindrical, about the same diameter throughout, without definite demarcation between metasome and urosome; head fused with the first segment, rostrum well defined; urosome 4-segmented in female, 5-segmented in male; caudal rami short and armed with stout spines. First antennae 7-segmented, the second segment the longest, twice geniculate in male, at the distal ends of the second and fourth segments; second antennae with a minute 1-segmented exopod, attached to the side of the proximal endopod segment near its base, with indications of a jointing of the endopod segment at the point of attachment; maxilliped unguiculate, the terminal claw very long and slender. Exopods of the first four pairs of legs 3-segmented, endopods 2-segmented, tipped with a single long seta; fifth legs 2-segmented, the inner expansion of the basal segment with two setae.

Genotype.—*Paraleptastacus brevicaudatus*, new species.

Remarks.—This new genus resembles *Leptastacus* in the peculiar and strong development of the maxillipeds and in the general character of the mouth parts and swimming legs, but it differs markedly in the first antennae, the second maxillae, the fifth legs, and the caudal rami. Its habitat is also very different, since it is a burrower in the sand at or below low-water mark.

KEY TO THE SPECIES (BOTH SEXES)

1. Caudal rami as wide as long, with a short apical spine, 2 setae and a short seta on dorsal surface____ **brevicaudatus**, new species (p. 249)
   Caudal rami longer than wide, with a long apical spine, 4 setae and a long seta on dorsal surface_______ **katamensis**, new species (p. 251)

PARALEPTASTACUS BREVICAUDATUS, new species

Plate 9

Occurrence.—One hundred males and females were washed from the sand of Buzzards Bay bathing beach at Woods Hole, July, 1927. The male holotype is U.S.N.M. No. 63428. This sand was washed for the purpose of obtaining nematodes for Dr. N. A. Cobb; the copepods were washed out with the nematodes and kindly turned over to the author for study.

Color.—Body transparent and whitish, without pigment markings; eggs white.

Female.—Cephalothorax the longest segment in the body, the other segments all about the same length except the anal segment which is shorter. Rostrum triangular, not well defined at the base, and bluntly pointed at its tip; genital segment not divided; anal segment half as long as penultimate segment, anal operculum fringed with minute spines along its posterior margin. Caudal rami as wide as long, each with a short triangular spine at its inner distal corner, a long seta just outside of the spine, a short seta on the outer margin, and a stout seta on the center of the dorsal surface. The long apical setae are often curved like parentheses and are about as long as the urosome.

The first antennae are a little longer than the cephalic segment and 7-segmented, the second segment the longest with a longitudinal row of three setae on the dorsal surface near the distal end. From the inner distal corner of the fourth segment a slender aesthetask extends nearly to the tip of the antenna; the terminal segment is about as long as the two preceding segments combined, and is well armed with setae. The endopod of the second antenna is 2-segmented, the basal segment twice the length of the terminal with some indications of division at the point of attachment of the exopod; the latter is short, 1-segmented, and tipped with two unequal setae. The second maxillae have two terminal claws of about the same length, an outer spine, and an inner process tipped with two minute spines. The maxillipeds are strongly developed with a slender apical claw longer than the second segment and curved near its tip where it is armed with seven or eight minute cilia placed some distance apart. Outside of the claw and attached to its base is a long slender accessory spine.

The rami of the first legs are about equal, the three segments of the exopod the same length and swollen through the center, the two basal segments each with a single spine on its outer margin, the end segment with two spines and two setae, the outer seta geniculate. The two segments of the endopod are also equal in length, the basal segment with a seta on the inner margin near the center, the distal segment with two unequal apical setae. Rami of the second legs subequal, the three exopod segments elongate and narrow, the two basal segments with one long and three short spines on the outer margin, the end segment with three unequal apical setae and no spines. The two endopod segments are sparsely fringed with minute hairs on the outer margin, the basal segment has a slender seta on its inner margin, and the distal segment has a single long apical seta. In the third and fourth legs the exopod is considerably longer than the endopod and its segments are unequal. The two basal segments are unarmed on their inner margins, the distal segment of the third exopod has a long inner seta, two apical setae, and two outer spines. The distal segment of the fourth exopod has two short outer spines, one long spine at the distal corner, two unequal apical setae, and two modified inner setae. Each of the latter has an elliptical swelling near its tip, with a dark central spot, and ends in a mucronate point. The endopods of the third and fourth legs are tipped with two unequal setae. The basal expansion of the fifth legs is nearly as long as the distal segment, with two unequal apical setae and its inner margin minutely denticulate. The distal segment is oval, with a single elongate apical spine and four shorter setae on the outer margin. Total length, 0.35–0.45 mm.

Male.—Body similar to that of the female except that the cephalic segment is relatively longer, the genital segment is shorter, and the urosome is 5-segmented. First antennae twice geniculate, once between the second and third segments, and again between the fourth and fifth segments, the last three segments usually turned backward. The second antennae, mouth parts, and swimming legs are like those of the female, without sexual modifications. The first endopod is tipped with two unequal setae, the three following endopods each with a single long seta. The fifth legs are reduced in size; the basal expansion is as long as the distal segment, is tipped with two short setae, and has a smooth inner margin. The distal segment is very small, with a long apical spine and three much smaller ones on its outer margin. Rudiments of a sixth pair of legs are present on the ventral surface of the genital segment in the form of a broad lamella on either side, armed with three subequal setae. Total length, 0.3–0.4 mm.

Remarks.—This species may be recognized by its minute size, its elongated cylindrical body, and its peculiar caudal rami. It is peculiar in that the male shows no sexual modifications in the swimming legs. Its joints are all mobile, and it moves about in the interstices between the sand grains much like a worm, twisting and crawling in every direction. The peculiar spines on the inner margin of the end segment of the fourth exopod in the female are also noteworthy and are not found in the following species.

PARALEPTASTACUS KATAMENSIS, new species

PLATE 10

Occurrence.—Two females and three males were washed from the sand on the shore of Katama Bay, Marthas Vineyard, August, 1927. The male holotype is U.S.N.M. No. 63429.

Color.—Body transparent and whitish, without pigment markings; eye invisible.

Female.—Cephalothorax as long as the two following segments combined, and the same length as the genital segment; rostrum relatively shorter than in *brevicauda*, but triangular and not well defined at its base. Genital segment not divided, one-half longer than the fifth segment; anal segment as long as the penultimate segment; anal operculum with a smooth posterior margin. Caudal rami longer than wide, each with a long stout spine at its inner distal corner, a short spine inside of it and two slender setae outside of it, and a slender seta on the dorsal surface of the ramus close to its tip.

First antennae 7-segmented, the second segment elongated, with a longitudinal row of three setae on the dorsal surface, the middle seta of the three sometimes transposed to one side, out of line with the other two. The aesthetask on the fourth segment reaches well beyond the tip of the antenna; the apical segment is armed with eight or ten setae, the others are sparsely setose. The basal segment of the endopod of the second antenna is more distinctly divided than in the preceding species, the exopod is much shorter and is attached at the joint. In the second maxillae the two terminal claws are longer and enlarged at the base, the outer spine is changed to a fingerlike process with a tuft of cilia at its tip, and the two short spines on the inner process are ciliated. The terminal claw of the maxillipeds is one-half longer than the second segment, is pectinate near the tip, and carries an outer accessory spine.

In the first legs the exopod is shorter than the endopod and the latter is tipped with two geniculate setae; the endopod of the second, third, and fourth legs is tipped with a single straight seta, and is shorter than the exopod. The basal expansion of the fifth legs reaches the tip of the distal segment, and has two equal apical setae and a smooth inner margin. The distal segment is very small, twice as long as wide and narrowed at its tip, with a long apical seta and a shorter one on the outer margin. Total length, 0.7–0.75 mm.

Male.—A little smaller and more slender than the female; cephalic segment about one-third the length of the metasome; second segment longer than the third, and fifth segment a little longer than the fourth; urosome distinctly 5-segmented, anal segment only three-fourths as long as penultimate segment; anal operculum with smooth posterior margin. Caudal rami twice as long as wide, with a stout apical spine, a slender but longer one at the inner distal corner, three very unequal ones at the outer corner, and one on the dorsal surface. First antennae twice geniculate, the terminal portion of two segments equal in length, the fourth segment much longer than either the third or the fifth; second antennae like those of the female.

In the first legs the exopod does not reach the center of the distal endopod segment, its three segments diminish in length distally, and it has no inner setae. Both segments of the first endopod are fringed with hairs on their inner margins, and the end segment carries two long geniculate apical setae. In the second legs the two endopod segments have a row of stout spines running lengthwise on the anterior surface near the outer margin and no hairs on the inner margin. The third and fourth endopods are unarmed except for the single apical seta; the second and third exopods have no inner setae, the fourth exopod has one inner seta on the middle segment and two on the distal segment. The apical setae of the basal expansion of the fifth legs are very unequal and the inner margin is denticulate. The distal segment does not reach the tip of the basal expansion, is quadrangular in shape, as wide as long, with four setae, the inner terminal one the longest. Total length, 0.6–0.7 mm.

Remarks.—This species is nearly twice the size of the preceding one, and can be further distinguished by the length and armature of the caudal rami and the fifth legs. Its habits and habitat are very nearly the same.

Genus LEPTASTACUS T. Scott, 1906

Body slender, elongate, cylindrical, with no demarcation between the metasome and urosome; head fused with the first segment; rostrum well defined at its base; urosome 4-segmented in female, 5-

segmented in male; genital segment divided in the male, undivided in female; caudal rami longer than the anal segment and slender. First antennae long and slender, 7-segmented, twice geniculate in the male; second antennae with the basal endopod segment divided and the 1-segmented exopod attached at the joint. Maxillipeds strongly developed, the terminal claw slender, sinuate, pectinate near its tip, and accompanied by an outside spine. Exopods of swimming legs 3-segmented, endopods 2-segmented, both rami with the setae reduced in number; the two segments of the fifth legs completely fused into a single triangular lamella, without distinction of parts.

LEPTASTACUS MACRONYX (T. Scott)

FIGURE 165

Tetragoniceps macronyx T. SCOTT, 10th Ann. Rep. Fishery Board Scotland, pt. 3, p. 253, pl. 10, 1892.

Leptastacus macronyx SARS, Crustacea of Norway, vol. 5, p. 417, suppl. pl. 40, 1911.

Occurrence.—A few specimens of both sexes were washed from the sand on the shore of Katama Bay, Marthas Vineyard, August, 1927.

Distribution.—Scottish coast (T. Scott); Norwegian coast (Sars).

Color.—Body transparent and colorless, without pigment markings; eye invisible.

Female.—Cephalic segment one-fourth the body length; rostrum spindle-shaped with a minute seta on each lateral margin near the center; urosome seven-tenths as long as metasome, slightly tapered posteriorly; genital segment not divided, nearly as long as the two basal abdominal segments combined; caudal rami slender, almost five times as long as wide, somewhat divergent and tapered distally, each with two apical setae, one outer, one inner, and one dorsal, all at the apex. First antennae reaching the fourth thoracic segment, their three basal segments equal in length, and together twice the length of the other four segments. Endopod of first legs longer, of second, third, and fourth legs shorter, than the exopod; basal segment of first, second, and third endopod with an inner seta; fourth endopod half the length of the exopod, without an inner seta. Exopod of first and second legs without inner setae, of third leg with one seta on end seg-

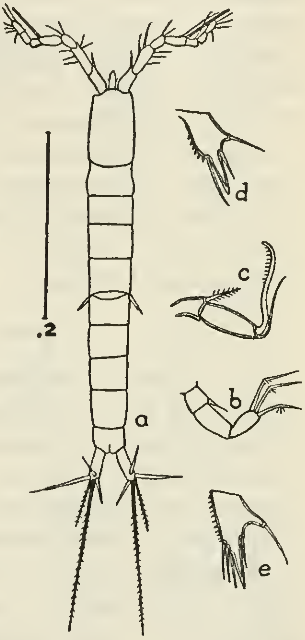

FIGURE 165.—*Leptastacus macronyx*: *a*, Male, dorsal; *b*, male, second antenna; *c*, male, maxilliped; *d*, male, fifth leg; *e*, female, fifth leg

ment, of fourth leg with one seta on second segment and two on end segment. Fifth legs a triangular lamella, the outer angle representing the outer process of the basal segment and tipped with a filiform seta; the distal angle passes into a stout and acute spine, with three inner and one outer bristles at its base. Total length, 0.5–0.7 mm.

Male.—Smaller and more slender than the female, fifth segment a little longer than the fourth; genital segment distinctly divided; caudal rami stouter than in the female, three times as long as wide, with a similar armature. First antennae twice geniculate, the segments divided 3, 2, and 2; second antennae with but three apical setae, all geniculate; maxillipeds like those of the female but smaller. Swimming legs showing no sexual modifications; fifth legs with but a single inner bristle at the base of the apical spine, otherwise as in the female. Total length, 0.45–0.55 mm.

Remarks.—This copepod may be recognized by its slender elongate form in connection with the caudal rami and the fifth legs, the latter projecting beyond the lateral margins of the body in dorsal view. This is the first record of the species outside of Scotland and Norway.

Genus EVANSULA T. Scott, 1906

Body elongate and cylindrical, much resembling *Leptastacus;* head fused with the first segment; rostrum prominent and well defined at its base; urosome 4-segmented in female, 5-segmented in male; genital segment not divided in female, divided in male; caudal rami not longer than anal segment, the apical setae enlarged at the base and geniculate. First antennae 7-segmented, strongly hinged in the male; basal endopod segment of second antenna divided, the 1-segmented exopod attached at the joint; maxillipeds normally developed. Exopods of swimming legs 3-segmented; first endopod 2-segmented, second, third, and fourth endopods 1-segmented in female; in the male the second endopod is 1-segmented, the third and fourth endopods 2-segmented; the second exopod and the third endopod are sexually modified in the male. The segments of each fifth leg are fused into an elongate lamella, tipped with a large spine with setae on the outer and inner margins. One species found here.

EVANSULA INCERTA (T. Scott)

FIGURE 166

Tetragoniceps incertus T. Scott, 10th Ann. Rep. Fishery Board Scotland, pt. 3, p. 254, pl. 12, 1892.

Evansia incerta Sars, Crustacea of Norway, vol. 5, p. 415, suppl. pl. 39, 1911.

Evansula incerta T. Scott, Proc. Roy. Phys. Soc. Edinburgh, vol. 16, no. 7, p. 342, 1906.

Occurrence.—A few specimens of both sexes were washed from the sands on the shore of Katama Bay, Marthas Vineyard, August, 1927.

Distribution.—Scottish coast (T. Scott); Norwegian coast (Sars).

Color.—Body transparent with a whitish tinge, but without pigment markings; eye invisible.

Female.—Slender and cylindrical, with almost no distinction between metasome and urosome; cephalic segment short; rostrum small but well defined and acute at the tip; urosome four-fifths as long as metasome; genital segment not divided; anal segment as long as penultimate segment; caudal rami as long as anal segment, tapered distally, each with a dorsal tooth and filiform seta in front of the middle, two or three outer setae, and an apical seta which is stout and spiniform proximally and passes abruptly at an angle into a filiform distal portion.

Two basal segments of first antennae enlarged and together as long as the other five segments; exopod of first leg much shorter than basal endopod segment, the latter linear with an inner seta; no inner setae on any of the exopods; fifth leg triangular, with a stout terminal spine, 4 inner and 3 outer setae, without any trace of segmentation. Total length, 0.75–0.85 mm.

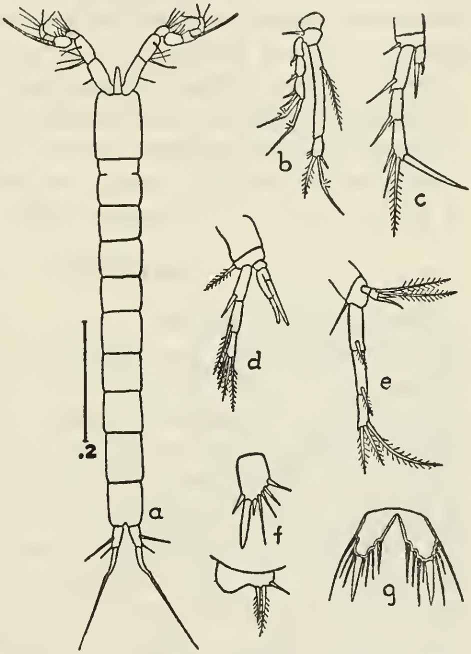

FIGURE 166.—*Evansula incerta: a,* Male, dorsal; *b, c, d, e,* male, first, second, third, and fourth legs; *f,* male, fifth and sixth legs; *g,* female, fifth leg

Male.—As large as the female; cephalic segment less than half as long as the rest of the metasome, the other body segments all about the same length; genital segment distinctly divided; caudal rami slender, half the length of the anal segment, three times as long as wide; apical setae enlarged at the base and filiform distally. First antennae much longer than the cephalic segment, the two basal segments together considerably longer than the rest of the antenna, the fourth segment swollen and armed with a slender aesthetask. The exopod of the second antenna is somewhat stouter than in the female, with two subequal apical setae. The terminal claw of the maxilliped is shorter than the second segment and without an accessory spine. The first endopod is twice the length of the exopod and has three apical setae, the inner one very small; its basal segment is five times the length of the terminal segment and carries a long and slender inner seta. The second endopod is 1-segmented and less than half the length of the basal exopod segment; the apical spine of the exopod is considerably enlarged and turned inward at right angles to the long axis of the exopod. The endopod of the third leg is 2-segmented, the basal segment very short, the distal segment ending in a short blunt spine, with a much longer spine on the inner margin near the center; this latter spine is dark reddish brown and quite conspicuous. The endopod of the fourth leg is very short but distinctly 2-segmented and tipped with two unequal short setae, with two other elongate setae on the posterior surface. The fifth legs are simple divergent laminae, each tipped with a long stout spine, with a short spine on either side of it at its base, and four slender setae on the outer margin. Total length, 0.75–0.85 mm.

Remarks.—This species can be recognized by the peculiar caudal setae and the fifth legs, and it has never before been found outside of the Scottish and Norwegian coasts.

EMERTONIA, new genus

Body somewhat depressed, the metasome wider than the urosome; head fused with the first segment and shorter than the rest of the metasome; urosome 4-segmented in female, 5-segmented in male; genital segment undivided; caudal rami lamellar, elongate. First antennae 8-segmented, the segments saucer-shaped and more or less telescoped in the female, enlarged and angular in the male; exopod of second antenna 1-segmented. Segments of first exopod fused into one, endopod 2-segmented, both rami prehensile; exopods of second, third, and fourth legs 3-segmented, endopods 1-segmented, with a single apical seta; fifth legs 2-segmented, basal expansion rudimentary and unarmed. A single ovisac. One species found here.

Genotype.—*Emertonia gracilis*, new species.

EMERTONIA GRACILIS, new species

PLATE 11

Occurrence.—Both sexes in considerable abundance were washed from the sand of Buzzards Bay bathing beach at Woods Hole (male holotype, U.S.N.M. No. 63430); it was also obtained in smaller numbers in the sand at Nobska bathing beach and on the shore of Cape Cod Bay at Dennis bathing beach.

Color.—Body transparent and colorless, without any markings; eye invisible.

Female.—Body somewhat depressed and tapered backward; free thoracic segments short and all about the same length, the second and third segments as wide as the cephalic segment, the fourth and fifth segments narrowed. Urosome, including the caudal rami, about as long as the metasome; genital segment with nearly straight lateral margins. First abdominal segment nearly as long as the other two combined; anal segment deeply incised posteriorly; caudal rami lamellar, three times as long as wide, the inner apical seta twice the length of the outer, each ramus with a coarse pectinate spine at the outer distal corner and a small spine at the center of the outer margin.

Rostrum short, blunt, and not defined at its base. First antennae 8-segmented, the second segment the longest with a small rounded protuberance on its posterior margin; third segment with a small spine and seta on its posterior margin; fourth segment with a slender aesthetask reaching well beyond the tip of the antenna. Endopod of second antenna 3-segmented, the 1-segmented exopod attached to the tip of the basal segment, and armed with two apical and one lateral setae. Maxilliped with a short and stout apical claw and a long slender accessory spine.

Exopod of first legs a single segment, but the arrangement of the spines on the outer margin, compared with those on the other legs, indicates that it is really three segments fused; the inner margin is perfectly smooth and unarmed. The endopod is 2-segmented, longer than the exopod, its distal segment longer than the basal, with two small apical claws and two spines on the inner margin near the tip. Exopods of second, third, and fourth legs distinctly 3-segmented, with an outer spine on each segment and two unequal apical spines; endopods 1-segmented and club-shaped, each tipped with a single seta. Basipods of all four pairs of legs somewhat geniculate, but not carrying the rami to the lateral margins of the body. Outer seta of the second basipod near the tip of the segment in the first legs, but at the center of the outer margin in the three following pairs. Fifth legs 2-segmented, the basal segment with a very much reduced inner expansion, which reaches the midline but is wholly unarmed. Distal segment very small, strongly constricted at its base, with a minute spine and a medium plumose seta at its apex, and a much smaller seta on the outer margin. Total length, 0.25–0.35 mm.

Male.—About the same length as the female but more slender, the metasome segments separated by deep lateral sinuses. Urosome two-thirds as long as metasome and considerably tapered posteriorly; abdominal segments subequal in length, the anal segment relatively longer than in the female; caudal rami longer than the anal segment, with the outer spine close to their base.

First antennae twice geniculate, the second and third segments with broadly rounded projections on the posterior margin, the fifth segment much swollen and trapezoidal in outline, the sixth segment also swollen, the seventh and eighth tapered. The aesthetask is on the fifth segment, is much widened, and is bent near its center. In the first legs the endopod is about twice the length of the exopod and its basal segment is five times as long as the end segment; the latter is invaginate on its inner margin and carries two unequal apical claws. The exopod is fused into a single segment, but its component parts are not indicated as clearly as in the female. The other three pairs of legs show no sexual modifications; the fifth legs are also very similar to those of the female, the distal segment not as strongly narrowed at its base and its terminal spine much stouter. Total length, 0.25–0.35 mm.

Remarks.—This copepod is the smallest adult found within the present area, and can be further identified by the first antennae, the caudal rami, and the first legs. It swims very feebly, but crawls about among the sand grains with considerable agility.

QUINTANUS, new genus

Body slightly depressed; head fused with the first segment, a little more than half the length of the rest of the metasome, and the widest part of the body; second segment longer than either of the three following segments, and slightly narrower than the head, the rest of the body tapered regularly backward. Urosome only two-fifths of the length of the metasome; genital segment divided; anal segment longer than the penultimate segment; caudal rami short and wide, their apical setae very short. First antennae 6-segmented, swollen, and geniculate in male; endopod of second antennae 2-segmented, tipped with two laminate setae, exopod 1-segmented. Exopods of first four pairs of legs 3-segmented, endopods 2-segmented, distal segment much longer than basal, setae on all the rami reduced in number; fifth legs 2-segmented, but the segments completely fused in both sexes. A single ovisac.

Genotype.—Quintanus tenellus, new species.

QUINTANUS TENELLUS, new species

PLATE 12

Occurrence.—Twenty-five specimens, including both sexes, were washed from the sand of Buzzards Bay bathing beach at Woods Hole, July, 1927. The male holotype is U.S.N.M. No. 63431.

Color.—Body transparent, with a decided whitish tinge but without pigment markings; eggs bluish; no eye visible.

Female.—Cephalic segment rather squarely truncated anteriorly and narrowed posteriorly where it joins the second segment; rostrum a mere knob, invisible in dorsal view; fifth segment with a small spine at each posterior corner; anal segment broadly rounded posteriorly, without a central incision. Caudal rami as wide as long, each with two longer and three very short setae at the apex, and a short one on the outer margin near the base of the ramus. The longest apical seta is shorter than the three abdominal segments combined.

The three basal segments of the first antenna combined are three times as long as the three terminal segments; the second segment is the longest and is armed with two large doubly pectinated setae, one on the dorsal and one on the ventral surface, near the posterior margin. The fourth segment is very short, but its aesthetask is elongate and slender; the terminal segment is armed on its posterior surface with a curved clawlike spine, which carries a row of slender spinules of unequal length along its posterior margin.

The terminal segment of the endopod of the second antenna is only half the length of the basal segment, and has a transverse row of stiff spinules on its dorsal surface near the tip. At the apex are two broad lamellar spines, the outer one pectinated on its anterior margin, the inner one smooth. The exopod is as wide as long, with three terminal and one lateral setae, and is attached to the side of the basal endopod segment at its center. The maxilliped is rather long and slender, its terminal claw shorter than the second segment; chewing blade of the mandible with an angular outer process, palp rudimentary, without any trace of an outer ramus.

The outer margins of the exopod segments of the first four pairs of legs are fringed with spinules in addition to the spine at the distal corner, and the end segment has three unequal apical setae; there are no inner setae. The endopods are armed only at the apex of the end segment; the first endopod has three setae, the middle one more than twice the length of the other two. The second endopod has four setae, the outer and inner ones very short; the two middle ones and the three apical setae of the exopod are elongate-flagellate, enlarged at the base and densely tufted with cilia at the tip. The third endopod has two equal plumose setae, the fourth endopod has two stout spines and two short setae.

The two segments of the fifth legs are completely fused into a broad lamina, covered on its ventral surface near the base by transverse rows of spinules. The two laminae meet and are fused across the midline; each carries 10 large setae, the bases of which are swollen into broad laminae that almost touch one another, and cover practically the entire ventral surface of the fifth segment. The plumes on these setae are confined to the distal tapering shafts of the setae. The meeting point of the distal segment and the basal expansion is indicated by a narrow invagination between the fifth and sixth setae, and there is also a well-defined outer process at the base of the lamina on the outside. The exceptional structure of these legs has given rise to the generic name, which signifies "the fifth in order." Total length, 0.4–0.45 mm.

Male.—Body of the same size and proportions as that of the female; first antennae geniculate and considerably swollen, the fourth segment enlarged into the ellipsoidal hand of a sort of chela the dactylus of which is formed by the two terminal segments, which are attached to the posterior surface of the hand a little beyond its center; the terminal segment ends in a short, stout, curved claw.

The other appendages are like those of the female except the fifth legs, which are greatly reduced in size, the two segments completely fused and very short, the setae small and normal in structure. The part corresponding to the basal expansion carries two equal setae, that representing the distal segment, three setae, the middle one a trifle longer than the others, all five plumose. Total length, 0.4–0.45 mm.

Remarks.—The chief characteristics of this genus are the long, flagellate setae of the second legs and the remarkable structure of the fifth legs in the female. This species is a very poor swimmer and is not so agile as most of the other forms that inhabit the sand. Although thus far found on only one beach, further examination will probably reveal its presence elsewhere.

GOFFINELLA, new genus

Body elongate and cylindrical, without demarcation between metasome and urosome; head fused with the first segment; rostrum very large and prominent. Urosome tapered posteriorly, 4-segmented in female, 5-segmented in male; genital segment distinctly subdivided in female; caudal rami short and broadly lamellar, the lateral seta transformed into a long and wide stylet.

First antennae 8-segmented in female, 9-segmented in male; exopod of second antenna minute and 1-segmented; maxilliped strongly developed and uncinate. Endopod of first legs 2-segmented, longer than exopod; the latter and both rami of the three following pairs of legs 3-segmented; both rami of fourth legs with laminate apical processes; fifth legs 2-segmented, setose. Two ovisacs; eggs very large.

Genotype.—Goffinella stylifer, new species.

Remarks.—This genus is very anomalous and must probably be placed in a family by itself. It resembles the Diosaccidae in the double ovisac and the second antennae, but differs radically in the structure of the mouth parts and the swimming legs. It resembles the Canthocamptidae in these latter particulars, but the female carries two ovisacs, which would seem to exclude it from that family.

The genus is named for Robert Goffin, biologist of the United States Bureau of Fisheries, without whose efficient assistance much of the collecting necessary for this paper would have been impossible.

GOFFINELLA STYLIFER, new species

PLATE 13

Occurrence.—Ten specimens, including both sexes, were washed from the sand of Buzzards Bay bathing beach at Woods Hole, July, 1927 (male holotype, U.S.N.M. No. 63432); a few females were also obtained from the sand of the Nobska bathing beach on Vineyard Sound.

Color.—Body transparent with a decided whitish tinge; eggs greenish blue and opaque; no eye visible.

Female.—Metasome somewhat compressed, cephalic segment as long as the three following segments combined, its epimeral portions turned downward and covering the bases of the mouth parts and first legs. Rostrum large, tongue-shaped, well defined at its base, and carrying a small seta on each lateral margin. Free thoracic segments diminishing in length backward, the fifth segment half the length of the second. Urosome three-fourths as long as the metasome; genital segment distinctly divided; anal segment a little shorter than the penultimate segment; caudal rami slightly longer than wide, the inner apical seta as long as the anal segment and caudal ramus combined. The lateral seta of each ramus is transformed into a stout acuminate stylet, attached to the distal corner of the ramus, as long as the apical seta and extending outward at right angles to the axis of the ramus.

The first antennae are slender, the second segment the longest, the four terminal segments only half the length of the four basal ones; the aesthetask is slender and reaches but little beyond the tip of the antenna; the two end segments are setose on both margins. The endopod of the second antenna is 2-segmented, the basal segment two and one-half times as long as the distal segment; the exopod is minute, attached to the side of the basal endopod segment near its center, and tipped with two tiny setae. The second maxilla is 3-segmented, with two terminal clawlike spines; the maxilliped is well developed, the second segment moderately swollen and fringed with scattered hairs on its inner margin, the claw longer than the second segment, jointed near its base and bipartite at its tip, with three small spines on its inner margin.

The endopod of the first legs is 2-segmented and longer than the exopod, its basal segment one-half longer than the terminal, fringed with hairs on its inner margin but without an outer seta. The end segment has three apical setae and a minute one on the outer margin; the middle apical seta is stouter than the others and blunt at its tip. The first exopod is 3-segmented, the segments the same length and without inner setae. The rami of the three following pairs of legs are 3-segmented, with the setae much reduced in number. In the fourth legs each ramus is terminated by a broad lanceolate lamina, with a single seta outside of it and a spine at the outer corner. The exopod segments of all four pairs of legs are fringed with spinules on their outer margins in addition to the regular spines. The fifth legs are 2-segmented, narrow and elongate; the basal expansion reaches beyond the center of the distal segment and is armed with two apical setae and one on the inner margin. The distal segment is twice as long as wide, contracted at its base and rounded at its tip, with five marginal setae. Total length, 0.45–0.55 mm.

Male.—A little smaller and more slender than the female; the urosome relatively narrower, the genital segment not divided. The anal segment is fully as long and as wide as the penultimate segment, and the lateral stylets on the caudal rami are even larger than in the female. The first antennae are twice geniculate and 9-segmented, the segments but little swollen, the fifth segment a little longer than the second, each of them with two setae close together on its posterior margin. The fourth segment is very short, with a single anterior seta; the end segment has a longitudinal row of setae along its dorsal surface. In the second antennae the basal endopod segment is three times as long as the distal; the exopod is longer than in the female but still 1-segmented and tipped with two setae; the distal segment has three apical setae which are considerably enlarged basally and only slightly geniculate. The terminal claw of the maxilliped is slender, is not jointed near the base as in the female, and carries only two inner spinules. The first four pairs of legs correspond with those of the female and do not show any sexual modifications. The fifth legs are reduced in size; the basal expansion is much narrower and does not reach the midline, but it carries similarly two apical setae and one on the inner margin near the tip. The distal segment is also twice as long as wide, projects less than half its length beyond the basal expansion, and has four apical setae, the second outer one filiform. Total length, 0.4–0.5 mm.

Remarks.—This species can be recognized at once by the large stylets on the caudal rami, standing out at right angles to the long axis of the ramus, and by the lanceolate laminae at the tips of the rami of the fourth legs. Each ovisac contains but two eggs, the diameter of which is at least three-fourths of that of the genital segment itself. It is a rapid swimmer and also moves about among the sand grains with great agility.

Family LAOPHONTIDAE

Genus LAOPHONTE Philippi, 1840

Body slender, the metasome passing insensibly into the urosome, the segments with conspicuous constrictions between them; head fused with the first segment and shorter than the rest of the metasome. Urosome 4-segmented, the segments more or less expanded into lateral lamellae; genital segment divided in the middle; caudal rami long and narrow. First antennae short, with not more than 7 segments; exopod of second antenna 1- or 2-segmented, attached to the side of the basal endopod segment. Exopod of first legs weak and short, 2- or 3-segmented; endopod very strong, 2-segmented, tipped with a single stout claw; exopods of second, third, and fourth legs 3-segmented; endopods 2-segmented, the third endopod 3-segmented and otherwise modified in the male; fifth legs 2-segmented, much reduced in the male.

KEY TO THE SPECIES

FEMALES

1. Fourth legs broad, laminate, and without setae ---- **talipes, new species** (p. 264)
   Fourth legs of normal form and armed with setae ---- 2
2. Caudal rami definitely shorter than anal segment; cephalic segment a little longer than wide; body much tapered ---- **manifera, new species** (p. 266)
   Caudal rami about as long as anal segment; cephalic segment much longer than wide or as wide as long ---- 3
   Caudal rami definitely longer than anal segment ---- 5
3. Distal segment and basal expansion of fifth legs each with only 3 plumose setae ---- **mohammed** (p. 269)
   Distal segment of fifth legs with 5 setae, basal expansion with 4 setae ---- **nana** (p. 271)
   Distal segment of fifth legs with 6, basal expansion with 5, setae ---- 4
4. Distal segment of fifth leg nearly as wide as long; third outer seta on basal expansion the longest ---- **strömii** (p. 273)
   Distal segment of fifth leg one-half longer than wide; middle seta of basal expansion the longest ---- **proxima** (p. 274)
   Distal segment of fifth leg two and one-half times as long as wide; second outer seta on basal expansion the longest ---- **cornuta** (p. 275)
5. Caudal rami five times as long as wide, outer spine close to the tip; no spines on dorsal surface of body ---- **longicaudata** (p. 276)
   Caudal rami twice as long as wide, 2 outer spines at center of outer margin; no spines on body ---- **capillata, new species** (p. 277)
   Caudal rami three times as long as wide, outer spine close to tip; 2 rows of dorsal spines on body ---- **horrida** (p. 279)

MALES

1. Endopods of second and third legs 2-segmented ---- 2
   Endopods of third legs 3-segmented, of second legs 2-segmented ---- 4
2. Endopod of second leg only reaching tip of first exopod segment, a short angularly bent spine on inner margin of end segment ---- **manifera, new species** (p. 266)
   Endopod of second leg reaching center of second exopod segment, a long S-shaped spine on inner margin of end segment ---- **strömii** (p. 273)
   Endopod of second leg reaching tip of second exopod segment, no spine on inner margin of end segment ---- 3

3. Distal segment of second endopod with 4 setae, of second exopod not turned inward and longer than second segment ---------- talipes, new species (p. 264)
   Distal segment of second endopod with 3 setae, of second exopod turned inward and shorter than second segment ---------- capillata, new species (p. 277)
4. Basal expansion of fifth legs obsolete, no setae; sixth legs present ---------- 5
   Basal expansion of fifth legs present, armed with 1 or 2 setae ---------- 6
5. Distal segment of fifth leg as long as outer process of basal segment, 3-lobed at its tip, with 3 setae ---------- horrida (p. 279)
   Distal segment of fifth leg shorter than outer process of basal segment, 2-lobed at its tip, with 2 setae ---------- mohammed (p. 269)
6. Distal segment of fifth leg as wide as long, basal expansion with 1 seta; rudiments of sixth legs not present ---------- longicaudata (p. 276)
   Distal segment of fifth leg twice as long as wide, basal expansion with 2 setae; rudimentary sixth legs present ---------- cornuta (p. 275)

LAOPHONTE TALIPES, new species

Plate 14

Occurrence.—Fifty specimens, including both sexes and females with ovisacs, were washed from the sand on the shore of the French Watering Place on Naushon Island, August, 1927; a single male and female were washed from the sand on the surf beach of the southern shore of Marthas Vineyard, August, 1927. A male with a female in copula is taken as the type of the species, U.S.N.M. No. 63433; female paratype, U.S.N.M. No. 60425.

Color.—Body transparent with a pinkish or reddish tinge, the male often bluish; eggs pale blue; eye dark red.

Female.—Body slender and tapered regularly backward, with no sharp distinction between metasome and urosome; cephalic segment as wide as long; rostrum short and bluntly rounded with a seta on each side at the tip. Epimeral plates quite prominent at the posterior corners of the thoracic segments; genital segment distinctly divided in the middle; anal segment much longer than the penultimate segment; caudal rami twice as long as wide and somewhat divergent, the terminal seta half the body length. First antennae 6-segmented, two-thirds as long as the cephalic segment, and rather stout; the third segment has three long setae in a transverse row on its dorsal surface, the fourth segment is one-half longer than the third and carries a slender aesthetask, the fifth segment is very short and is the only one not well armed with setae. The two endopod segments of the second antenna are the same length; the distal segment has four apical setae, the two middle ones geniculate, and a row of slender spines on its inner margin, increasing in length and thickness distally. The basal segment is much stouter, with a fringe of hairs and one seta on its inner margin and a spine at the distal corner. The exopod is attached to the side of the basal endopod segment near its base, is three times as long as wide, with two equal apical setae. The maxilliped is short and stout, the inner margins of its two segments fringed with scattered hairs, the second segment but little swollen with a filiform seta on the ventral surface at the distal end, the apical claw no longer than the second segment and without an accessory bristle.

Both rami of the first legs are 2-segmented, the exopod not reaching the middle of the basal endopod segment, its two segments of equal length, the distal one with three spines and two geniculate setae. The basal endopod segment is the same width as the exopod segments, four times as long as the distal segment, and fringed with hairs on both lateral margins. The distal segment has an outer fringe of long hairs and inside the base of the apical claw one long and two short filiform setae. The endopods of the second and third legs do not reach the center of the distal exopod segment; the end segment of the second endopod has two long apical setae, a short one on the outer margin, two short ones and a spine on the inner margin. The end segment of the third endopod has two long apical setae, one short seta and a spine on the inner margin, and hairs only on the outer margin.

The fourth legs are greatly modified and give origin to the specific name, *talipes*, club-footed. Both rami are lamellar, strongly chitinized, considerably widened, and entirely without setae. The two basal exopod segments each carry a small outer spine, the distal segment is enlarged and lobed at its tip, with one small spine at the inner corner. The basal segment of the endopod is unarmed, the distal segment has a spine at each corner of the squarely truncated tip and one on the inner margin. In pairing the chelae of the first antennae of the male grasp the end segment of these fourth exopods on each side. The hold thus obtained is so firm that it persists even in preservatives, and it is very difficult to separate the pair without injury, The fifth legs are 2-segmented, the basal expansion much reduced and armed with three small setae, diminishing in size inwardly. The distal segment projects half its length beyond the basal expansion and is 3-lobed at its tip, the two inner lobes each with a single seta. the outer one with a knoblike spine. Total length, 0.38–0.45 mm.

Male.—A little smaller than the female, the cephalic segment longer than wide and squarely truncated posteriorly; the genital segment is not divided; the abdominal segments are much shorter than those of the female, and the anal segment is longer than the penultimate segment, but the urosome is relatively wider.

In the first antennae the two basal segments are enlarged and distinct, the third and fourth segments are fused into the hand of a powerful chela, which is almost spherical in shape, and to which is attached the aesthetask. The fifth and sixth segments are also fused into a curved, very stout, and bluntly pointed claw, which serves as the dactylus of the chela.

The first two pairs of legs are more slender than in the female; both rami of the first legs are 2-segmented, but the distal exopod segment is much longer than the basal. The proximal endopod segment is fringed with hair on its inner margin only and there are no setae on the distal segment inside the base of the apical claw. In the second legs the outer spines of the exopod segments are very slender, the outer apical seta of the end segment is pectinate on both margins, the inner seta is pectinate outwardly and plumose inwardly. The distal segment of the second endopod has two apical setae, also pectinate outwardly and plumose inwardly, and two short inner plumose setae.

The endopods of the third and fourth legs scarcely reach the tip of the first exopod segment and each carries three apical setae. The exopods are considerably enlarged and the end segments are armed with coarse spines as is usual in this genus. The sexual armature of the second and third endopods, so common in the males of other species, is here entirely lacking. The basal segment of the fifth leg has a very elongate outer process, but the inner expansion is practically obsolete and without setae. The distal segment is short, narrowed at its base, and armed with two long and equal apical setae. There is also on either side of the ventral surface of the genital segment a small lamina tipped with two unequal setae, the rudiment of a sixth leg.

Remarks.—The peculiar club feet constituting the fourth pair in the female show conspicuously under low magnification and will identify the species at once. It was very common in the sand under 5 or 6 inches of water, and was found in company with the species *mohammed* described on page 269. It is worthy of note that the water in this French Watering Place is strictly fresh and has no trace of salinity.

LAOPHONTE MANIFERA, new species

PLATE 15

Occurrence.—Both sexes were obtained in considerable abundance in surface towings in Sengekontacket and Nashaquitsa Ponds, Marthas Vineyard, August, 1926; in the Eel Pond at Woods Hole, July, 1925; in Great Pond, Falmouth, July, 1925. Female holotype from Sengekontacket Pond is U.S.N.M. No. 60341.

Color.—Body transparent and whitish with no pigment marks; eggs pale brown; no eye visible.

Female.—Slender and tapered regularly backward, with the segments separated by deep constrictions, but with no sharp demarcation between metasome and urosome. Cephalic segment of moderate size, a little shorter than the rest of the metasome; rostrum short, broadly rounded, poorly defined at its base, and armed at its tip with two minute setae. Fifth segment shorter than the fourth; genital segment distinctly divided; anal segment shorter than the penultimate segment; caudal rami one-half longer than wide, with squarely truncated tips, the inner apical seta as long as the metasome, the outer seta close to the tip of the ramus. All the body segments including the head are fringed with short hairs on their lateral and posterior margins.

The first antennae are much shorter than the cephalic segment and their two basal segments are somewhat enlarged. The two segments of the endopod of the second antennae are about the same length; the distal segment carries three geniculate setae and three clawlike spines; the exopod is very short and rudimentary and 1-segmented, tipped with two minute setae.

In the first legs the 3-segmented exopod reaches but little beyond the center of the basal endopod segment, is without inner setae, and its end segment carries two apical geniculate setae and two spines. The endopod is twice the width of the exopod, its basal segment is fringed with scattered hairs on both lateral margins, and its terminal claw is very long and slender, and abruptly curved near its tip. The second exopod is thick and stout, its end segment is fully as wide as its basal segment, and carries one apical and one inner setae and four spines. The endopod just reaches the tip of the second exopod segment and its two segments are about the same length; the distal segment carries two apical setae and two inner setae, the proximal one very small, the other three very elongate. In the third and fourth legs the endopod does not reach the center of the middle exopod segment and its distal segment is more than twice the length of the basal segment. In the third legs the distal segment carries two apical setae, one on the outer margin and three on the inner margin; the two apical setae and the inner seta next to them are much elongated. In the fourth legs the distal segment carries two apical, one inner and one outer setae, the first three greatly elongated. The end segment of the third exopod has at its apex one seta and one spine, both elongated, three outer spines and one inner seta; the end segment of the fourth exopod has at its apex two elongate setae, two outer spines and one inner seta.

In the fifth legs the distal segment is somewhat trapezoidal in form and projects more than half its length beyond the basal expansion; it is armed with six setae, the innermost of which is much shorter than the others. The basal expansion is rather narrow and carries five setae, the middle one the longest. Total length, 0.45–0.55 mm.

Male.—Somewhat smaller than the female and more slender, the urosome nearly cylindrical; first antennae much enlarged, especially the fourth segment, which is nearly circular in dorsal outline, with a small sinus on its posterior margin. The aesthetask is attached to this fourth segment and is as long as the four basal segments of the antenna combined; the second, fourth, and sixth segments are densely setose, the others only sparingly so. The first legs are similar to those of the female but more slender; the second and third legs are modified as is usual in this genus. The exopods of these two latter pairs of legs are stout and the terminal segments are bent inward nearly at right angles to the long axis of the legs. Each end segment is armed with six rather slender spines of very unequal lengths and a short inner seta. The endopods scarcely reach the tip of the basal exopod segment; the distal segment of the second endopod is shorter than the basal segment and carries three elongate apical setae and an inner spine. The latter is short and sharply bent twice into an S-curve, blunt at its tip. The distal segment of the third endopod is twice as long as the basal segment and is obliquely truncated at its tip, with a row of four apical setae and an outer spine. The latter is stout and curved slightly backward at its tip, and looks like the thumb of a hand, the fingers of which are the four apical setae; this resemblance to a hand has given rise to the specific name. The fourth endopod also just reaches the tip of the basal exopod segment; its distal segment is three times as long as the basal segment, and carries two apical and one inner setae, and a minute inner spine. The end segment of the fourth exopod has two apical setae, one inner seta, and three long and slender outer spines, the two distal ones setose.

The fifth legs are reduced to a narrow lamina reaching from the lateral margin to the midline, and bearing six setae. The outer seta is separated from the others and mounted on a small knob, which represents the outer process of the basal segment. The next two setae are close together and separated from the fourth and represent the distal segment of the leg. The three remaining setae represent the basal expansion; rudiments of sixth legs are also present. Total length, 0.4–0.5 mm.

Remarks.—This species is closely related to *strömii* but is much smaller and differs greatly in the details of the swimming legs, especially the second and third pairs in the male. This copepod was not washed out of the sand but was swimming freely in the plankton.

LAOPHONTE MOHAMMED Blanchard and Richard

FIGURE 167

Laophonte mohammed BLANCHARD and RICHARD, Mém. Soc. Zool. France, vol. 4, p. 526, pl. 6, figs. 1–16, 1891.

Occurrence.—Both sexes obtained in small numbers from the French Watering Place, Naushon Island, August, 1925; from one of the brackish ponds on Chappaquiddick Island, August, 1925; from Gosnold Upper Pond, Cuttyhunk Island, July, 1926; from Oyster Pond, Falmouth, July, 1926, a single male from Nashaquitsa Pond, Marthas Vineyard, August, 1926.

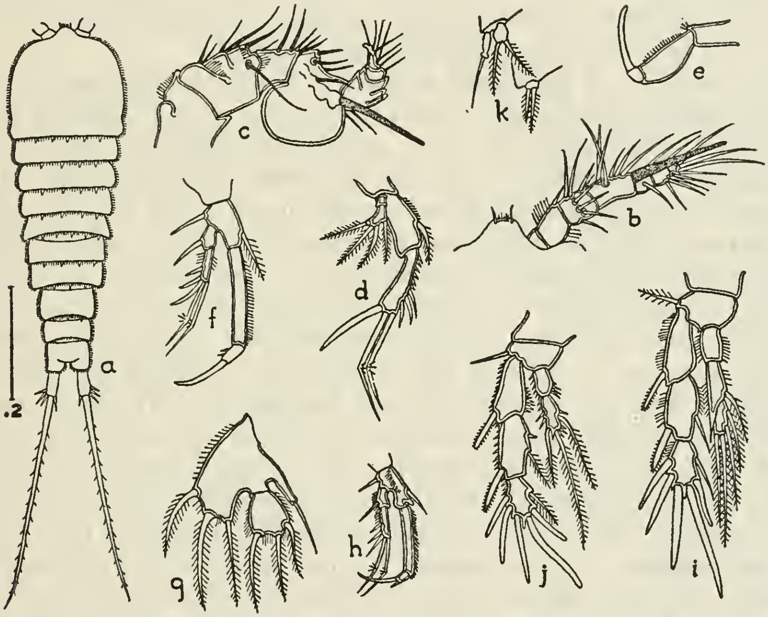

FIGURE 167.—*Laophonte mohammed: a,* Female, dorsal; *b,* female, first antenna; *c,* male, first antenna; *d,* male, second antenna; *e,* male, maxilliped; *f,* female, first leg; *g,* female, fifth leg; *h, i, j, k,* male, first, third, fourth, and fifth and sixth legs

Distribution.—Algeria (Blanchard and Richard); Germany (van Douwe).

Color.—Body grayish white and fairly transparent, without pigment markings; eggs dark gray; eye ruby red.

Female.—Body wide anteriorly and tapering quite regularly backward; cephalic segment longer than the rest of the metasome, widest posteriorly, with lateral sinuses indicating the division between head and first segment. Body segments distinct, raised dorsally and covered with fine short hairs, each segment with several small processes along its posterior margin; urosome three-fifths as long as metasome; genital segment distinctly divided; basal abdominal segment considerably narrower than the genital segment; anal segment longer than the penultimate segment, with a wide posterior sinus; caudal rami two and one-half times as long as wide, apical seta three-fifths of the body length.

Rostrum wider than long, well defined at its base, evenly rounded anteriorly and tipped with two setae some distance apart and a row of six stout bristles between their bases. First antennae 7-segmented, the four basal segments more than twice as long as the three terminal ones, the third, fourth, and seventh segments densely setose. The third segment has a transverse row of six large setae across the middle of the dorsal surface; the fourth segment has a bunch of large setae at the center of the anterior margin and a stout aesthetask at its distal end, whose basal half is much widened.

The endopod of the second antenna is distinctly 3-segmented; its end segment is longer and narrower than the second segment, with a row of spines along its inner margin, increasing in length outwardly and three apical setae, the two inner ones geniculate. The exopod is 2-segmented, the distal segment much longer than the basal and armed with two apical and two inner setae, all of equal length. The maxilliped is made up of three distinct segments and a terminal claw, the third segment very short, the second segment with a fringe of short inner hairs, the claw the same length as the second segment.

The endopod of the first legs is twice the length of the exopod, and both rami are very slender and 2-segmented. The basal endopod segment is five times as long as the distal segment and fringed with hairs on its inner margin; the distal exopod segment is longer than the basal segment, with two apical geniculate setae and three outer spines. The fourth endopod reaches the middle of the second exopod segment; its end segment has one apical, one outer, and one inner setae. The second endopod reaches beyond the tip of the second exopod segment; its end segment has two apical and two inner setae. The middle exopod segment of the second, third, and fourth legs carries an inner seta. The distal segment of the fifth legs projects but little beyond the basal expansion, is narrowed at its base, and 3-lobed at its apex, and each lobe is tipped with a seta, the inner one the longest. The basal expansion is broadly rounded, with three setae, the outer one the longest; the outer process of this basal segment is long and fingerlike, with a rather stout seta. Total length, 0.55–0.65 mm.

Male.—Considerably smaller than the female, but having the same general proportions. First antennae rather densely setose, the fourth segment greatly swollen posteriorly and produced at its base anteriorly into a hooklike process. The fifth segment is also swollen and produced laterally into coarse overlapping processes; the end segment is narrow and curved like the letter S.

The first legs are like those of the female except that the second basipod has a rounded process at its inner distal corner. The second, third, and fourth exopods are enlarged as usual and armed with coarse spines, but the end segments are not turned inward. The third endopod reaches the tip of the second exopod segment, and is distinctly 3-segmented; the second segment is produced at its outer distal corner into a flattened acuminate spine, which reaches beyond the tip of the end segment, and carries at the inner corner a plumose seta; the end segment has two apical and two inner setae. The fourth endopod does not reach the center of the middle exopod segment; its end segment is longer than the basal segment, and has one apical, one outer, and one inner setae. Between the bases of these setae and along the lateral margins of the segment are stout spinules.

Basal segment of fifth legs apparently absorbed into the body, leaving its outer process and the distal segment protruding side by side from the ventral surface of the fifth segment, without any trace of the inner expansion. The outer process is longer than the distal segment and ends in a small knob, which carries the single non-plumose seta. The distal segment is strongly narrowed at its base and 2-lobed at its apex, each lobe with a single plumose seta. Rudiments of a sixth pair of legs appear in the form of a small lamina tipped with two plumose setae on either side at the distal corner of the genital segment. Total length, 0.4–0.45 mm.

Remarks.—This is a bottom species and sticks closely to the algae and bottom débris, seldom coming out into the open and swimming about freely. Instead it crawls slowly through the débris and apparently can not move with any rapidity. When captured it is more or less covered with small particles of the substances through which it has been crawling, and these effectively conceal the " wartlike processes " along the posterior margins of the body segments. When once discovered, however, these together with the structure of the fifth legs will identify the species, which has not been reported outside of the localities mentioned above.

LAOPHONTE NANA G. O. Sars

FIGURE 168

Laophonte nana SARS, Crustacea of Norway, vol. 5, p. p. 262, pl. 182, 1908.

Occurrence.—Eight females were washed from sand dredged in 23 fathoms of water 12 miles south of No Mans Land, July, 1927.

Distribution.—Norwegian fiords (Sars).

Color.—Body a uniform pale yellow, oviducts and eggs with a greenish tinge, which becomes deeper in color as the eggs mature; eye invisible.

Female.—Body stout and a little depressed; cephalic segment the same length as the rest of the metasome, rostrum short and not well defined at its base. Urosome three-fourths as long as metasome; genital segment distinctly divided; caudal rami one-half longer than wide, apical seta half the body length. First antennae 6-segmented, two basal segments enlarged, second segment with a transverse row of setae across its dorsal surface; exopod of second antenna minute and attached to the side of the basal endopod segment. First exopod 2-segmented, half as long as endopod, its end segment twice the length of the basal segment with two apical geniculate setae and three outer spines. End segment of fourth exopod with three spines and two setae. Basal expansion of fifth legs strongly curved with four setae, the second outer one the longest. Distal segment ovate, contracted at its base, evenly rounded at its tip, with five setae, the second inner one the longest. Total length, 0.4–0.5 mm.

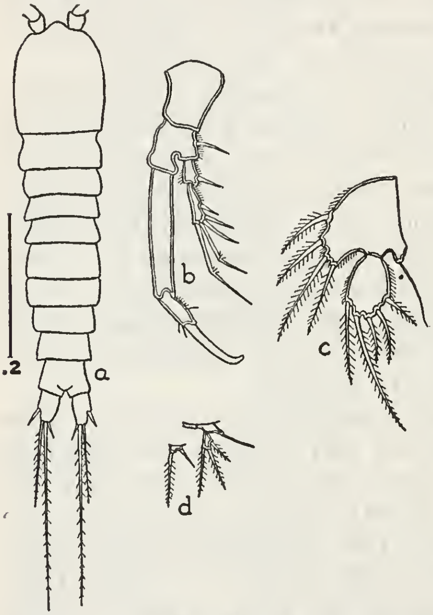

FIGURE 168.—*Laophonte nana: a,* Female, dorsal; *b,* female, first leg; *c,* female, fifth leg; *d,* male, fifth and sixth legs

Male.—Smaller than the female and more slender; second legs enlarged, the endopod reaching beyond the tip of the middle exopod segment, its end segment five times as long as wide, with two long apical setae and a very short inner one; third and fourth exopods enlarged and widened, especially the two basal segments of the third exopod, the end segments armed with very long and coarse spines. Third endopod 3-segmented, the spine on the middle segment bent outward and then forward into an S-shape; endopod of fourth legs tipped with three setae. Basal expansion of fifth legs obsolete, distal segment very small, narrowed at its base, with three setae, the inner one the longest; rudimentary sixth legs present on the ventral surface of the genital segment. Total length, 0.35–0.4 mm.

Remarks.—This species is the smallest of the genus and may be recognized by the structure of the first and fifth legs in the female, and of the third and fourth legs in the male. This is the first report of the species outside of Christiania Fiord, where Sars found it.

LAOPHONTE STRÖMII (Baird)

FIGURE 169

Canthocamptus strömii BAIRD, The natural history of the British Entomostraca, p. 208, pl. 27, figs. 3, 3a, 1850.

Laophonte strömi SARS, Crustacea of Norway, vol. 5, p. 251, pls. 171, 172, 1908.

Occurrence.—Thirty specimens, including both sexes, were obtained from Penzance Pond, Woods Hole, August, 1925; found in smaller numbers in one of the brackish ponds on Chappaquiddick Island, in Quisset Pond, Falmouth, the Eel Pond, Woods Hole, Great Pond, Falmouth, and Nashaquitsa Pond, Marthas Vineyard.

Distribution.—British Isles (Baird, Brady); Franz Josef Land (T. Scott); coast of Norway (Sars); Adriatic (Carazzi, Grandori, Pesta).

Color.—Pale yellowish white and quite transparent, without pigment markings; eggs white, each with a minute red dot at its center; eye dull red.

Female.—Body slender, four times as long as wide, tapered posteriorly; cephalic segment nearly as long as the rest of the metasome, the second, third, and fourth segments as wide as the head, the fifth segment considerably narrower; urosome two-thirds as long as metasome, the last two segments of abdomen of equal length; caudal rami twice as long as wide, squarely truncated at the tip, apical seta two-thirds as long as the whole body. First antennae 7-segmented, two basal segments enlarged; exopod of second antenna minute, 1-segmented, attached to side of basal endopod segment. Basal endopod segment of first legs stout, fringed with long hairs on both margins; first exopod 3-segmented, end segment with two apical geniculate setae and two outer spines. Fifth legs of moderate size; distal segment as wide as long, much narrowed at its base, with six very unequal setae, the second inner one filiform and much the longest; basal expansion reaching beyond the center of the distal segment, with five setae, the middle one the longest. Total length, 0.8–0.9 mm.

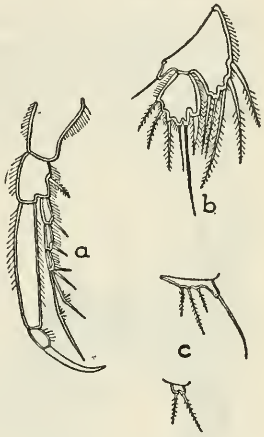

FIGURE 169.—*Laophonte strömii: a,* Female, first leg; *b,* female, fifth leg; *c,* male, fifth and sixth legs

Male.—Second and third metasome segments as wide as the head and much longer than the narrowed fourth and fifth segments; urosome cylindrical, the segments not expanded laterally. First antennae much enlarged, 6-segmented, the fourth segment swollen into a sphere, the end segment sharply pointed. Exopods of second and third legs greatly enlarged, the end segments turned diagonally inward, each with four huge divergent spines. Endopods of both these legs 2-segmented, end segment of second endopod with a long inner spine, enlarged and sharply curved at its tip. End segment of third endopod much dilated distally, with two apical and two inner setae, and a stout blunt spine outside of the apical setae with tubercles at its base. Fifth legs reduced to a narrow lamina, with a distinct outer process, but no division of basal expansion and distal segment, the lamina armed with three filiform setae; the genital segment carries the rudiments of a sixth pair of legs. Total length, 0.7–0.8 mm.

Remarks.—Sars's statement that this is a littoral species found among algae and sometimes in tide pools is abundantly confirmed in the localities from where the present specimens were obtained. The female can be distinguished by the details of the first and fifth legs, the male most quickly by the long spine on the second endopod. This is its first appearance in American waters.

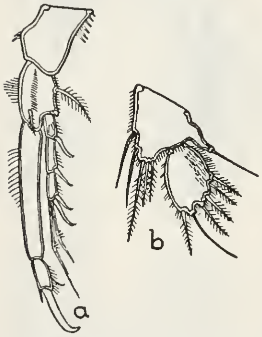

Figure 170.—*Laophonte proxima: a,* Female, first leg; *b,* female, fifth leg

LAOPHONTE PROXIMA G. O. Sars

Figure 170

Laophonte proxima Sars, Crustacea of Norway, vol. 5, p. 250, pl. 170, 1908.

Occurrence.—Four females were washed from the sand along the shore of the French Watering Place on Naushon Island, August, 1927.

Distribution.—Norwegian coast (Sars).

Color.—Body semitransparent with a decided brownish tinge; oviducts and eggs dark brown; eye dull red.

Female.—Body conspicuously depressed, the segments separated by rather deep constrictions; cephalic segment shorter than the rest of the metasome; rostrum short and broad with prominent apical filaments; second and third segments very nearly as wide as the head, and longer than the narrowed fourth and fifth segments. Urosome little more than half the length of the metasome, its segments well produced laterally; caudal rami as long as anal segment, apical setae three-fifths the body length. First antennae 7-segmented, the two basal segments enlarged, the second segment with several dorsal setae, the third segment narrow and elongate. First legs slender, the endopod twice the length of the exopod, its basal segment with a few long inner hairs; end segment of first exopod with two apical geniculate setae and two outer spines. Distal segment of fifth legs reaching three-fourths of its length beyond the basal expansion, densely covered with hairs near its outer margin, with six setae, the second inner one filiform and elongate. Basal expansion narrowed distally, with five setae, the two inner ones smooth, the middle one the longest. Total length, 0.75–0.9 mm.

Male.—Unknown.

Remarks.—This species can be recognized by the details of the first and fifth legs, and is here recorded for the first time outside of Norway. It is worthy of note that the present specimens came from perfectly fresh water, while Sars's types were taken from the ocean at moderate depths.

LAOPHONTE CORNUTA Philippi

Figure 171

Laophonte cornuta Philippi, Arch. Nat., Wiegmann, vol. 1, p. 189, pl. 3, fig. 13, 1840.—Sars, Crustacea of Norway, vol. 5, p. 235, pls., 157, 158, 1907.

Occurrence.—Both sexes were obtained from Nashaquitsa Pond, Marthas Vineyard, July, 1926; four females were also taken from one of the brackish ponds on Chappaquiddick Island, August, 1926.

Distribution.—Mediterranean (Philippi, Claus); Madeira (Fischer); British Isles (Brady); coast of Norway (Sars); Gulf of Genoa (Brian); Polar seas (Brady).

Color.—Body brownish white or gray, the first three free metasome segments darker and often pink or even dark red; these three and the cephalic segment are bordered posteriorly with narrow transverse bands of dark brown. In larger specimens irregular blotches of dark brown sometimes appear on the dorsal surface of the genital segment; eggs grayish white; eye ruby red.

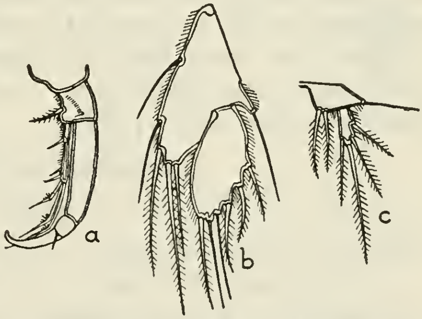

Figure 171.—*Laophonte cornuta: a,* Female, first leg; *b,* female, fifth leg; *c,* male, fifth leg

Female.—Body slender and subcylindrical, the posterior margins of the segments more or less elevated dorsally and fringed with knoblike spinules; cephalic segment with a dorsal cephalic depression; rostrum broad, ending in an obtuse knob. Urosome, including the caudal rami, as long as the metasome; anal segment quadrangular, operculum tipped with a stout spine, somewhat erect; caudal rami two and one-half times as long as wide, apical setae as long as the abdomen plus the caudal rami. First antennae 4-segmented, first segment with a small, second segment with a very large, spine on the posterior margin. Exopod of first legs 2-segmented, very narrow, end segment twice as long as basal segment with three apical geniculate setae and two outer spines; endopod very stout, with a strong terminal claw. Fifth legs lamellar; distal segment two and one-half times as long as wide, with two apical and four outer setae, the second and third inner ones filiform; basal expansion triangular, reaching beyond the center of the distal segment, with two apical and three inner setae, the second outer one the longest, the inner one far removed from the others. Total length, 0.95–1.1 mm.

Male.—Slightly smaller than the female; first antennae 6-segmented, strongly hinged, the two basal segments with spines, the fourth segment greatly swollen posteriorly and produced anteriorly into a hamiform process. Endopod of second legs unmodified; endopod of third legs 3-segmented, middle segment with a sharp spine reaching far beyond the tip of the end segment. Fifth legs much reduced in size; distal segment with three apical and one outer lobes, each with a seta; basal expansion nearly obsolete, but with two elongate setae. Total length, 0.9–1 mm.

Remarks.—This is one of the largest species of the genus and may be recognized by its size, its dark color, the large spines on the antennae, and the structure of the fifth legs. It is here reported for the first time from American shores. The nauplius and metanauplius stages are figured and described in Studi del Laboratorio Marino Genova, 1921 (p. 97).

LAOPHONTE LONGICAUDATA Boeck

FIGURE 172

Laophonte longicaudata BOECK, Forh. Vid.-Selsk. Christiania, 1864, p. 279.—SARS, Crustacea of Norway, vol. 5, p. 243, pl. 164, 1908.

Occurrence.—Fifteen females and one male were obtained from Sengekontacket Pond, Marthas Vineyard, July, 1926.

Distribution.—British Isles (Brady); coast of Norway (Sars, Boeck); Franz Josef Land (T. Scott); Adriatic (Car, Carazzi, Pesta); Woods Hole (Sharpe).

Color.—Body yellowish white, with three transverse bands of light orange, one across the cephalic segment just in front of its center, a second across the posterior half of the genital segment, and the third across the anal segment; eggs a dark gray, with an orange center; eye dull red.

Female.—Body slender, nearly five times as long as wide; cephalic segment longer than the rest of the metasome; rostrum broadly triangular, curved downward and 3-lobed at its tip; urosome three-fifths as long as metasome; anal segment as long as the penultimate segment; caudal rami as long as these two segments combined. First antennae 7-segmented, the two basal segments enlarged, the second segment with a small posterior spine; exopod of second antennae

1-segmented but well developed; exopod of first legs 3-segmented, end segment with two geniculate apical setae and two outer spines; distal segment of fifth legs narrow oval, with a straight inner margin and five setae, one terminal, one inner, and three outer, the terminal one filiform; basal expansion reaching the center of the distal segment, with five setae, one terminal, and four inner, the terminal one the longest. Total length, 0.65–0.75 mm.

Male.—A little smaller than the female; first antennae enlarged in the usual manner; endopod of third legs 3-segmented, the second segment with a slender spine at the outer distal corner extending to the tip of the terminal segment; exopod very wide and stout, twice the length of the endopod, its end segment with five long and stout spines, and two setae on the inner margin. Fifth legs very small, the distal segment narrow oval, with four setae, one terminal, one inner, and two outer, the terminal one much the longest; outer process of basal segment nearly as large as distal segment; inner expansion practically obsolete, but with a single seta. Total length, 0.6–0.65 mm.

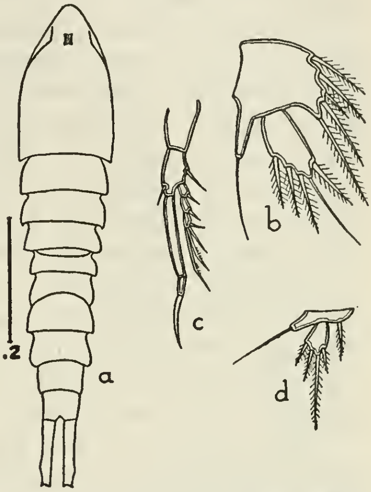

FIGURE 172.—*Laophonte longicaudata*: *a*, Female, dorsal; *b*, female, fifth leg; *c*, female, first leg; *d*, male, fifth leg

Remarks.—When alive this copepod can be at once recognized by its color, the three transverse orange-colored bands standing out prominently; in preserved material the long and slender caudal rami furnish the best single character. It is a littoral species living among the algae, and may be looked for in any of the larger salt-water ponds of the area.

LAOPHONTE CAPILLATA, new species

PLATE 16

Occurrence.—Twenty specimens, including both sexes and females with ovisacs, were washed from the sand on the shore of Katama Bay, Marthas Vineyard, August, 1927. The male holotype is U.S.N.M. No. 60426.

Color.—Body semitransparent and whitish, usually tinged with blue; eggs a greenish blue, deepening in color with development; eye dull red.

Female.—Elongate, narrow, somewhat depressed and but little tapered posteriorly; cephalic segment a little shorter than the rest of the metasome; rostrum short and 3-lobed at its tip the middle lobe with a short seta on either side at its base. Urosome five-ninths as long as the metasome; genital segment divided into equal portions; anal segment much shorter than penultimate segment, anal operculum triangular and acuminate posteriorly; caudal rami stout, slightly divergent and as long as the last two abdominal segments combined, apical setae as long as the urosome; two setae close together at the center of the outer margin of each ramus.

First antennae short, 6-segmented, and exceptionally stout for this genus, the four basal segments widened, the second segment with a row of five stout setae across its dorsal surface. The aesthetask on the fourth segment is slender and much elongated; the sixth segment is three times as long as the fifth and heavily armed with setae. The two endopod segments of the second antennae are about the same length but the distal one is much narrower than the basal, with five apical setae, of which the four outer ones are geniculate, and a row of spinules along the inner margin. The exopod is attached to the side of the basal endopod segment, and is very weak, 1-segmented with one terminal and one lateral seta. The maxillipeds are rather stout, the terminal claw the same length as the second segment, and without an accessory bristle.

The exopod of the first leg is 3-segmented, the end segment with two apical geniculate setae and two outer spines; the basal segment of the endopod is five times as long as the distal segment, with scattered hairs on its inner margin and a slender fingerlike process on the anterior surface near the distal end; the terminal claw is short and very slender and bent abruptly near its tip. The second basipod of this leg has a blunt ciliated spine on its outer margin, another spine on its anterior surface opposite the base of the endopod, and a longitudinal row of stout spinules running from this second spine back to the base of the segment. The rami of the second, third, and fourth legs are widened, and the endopod segments are fringed with long hairs on both margins, while the exopod segments have an outer fringe of coarse spinules. In the second and third legs the two basipod and the proximal exopod segments have also longitudinal rows of coarse hairs just inside the outer margin on the surface of the segments. The outer spine of these proximal exopod segments is blunt and pectinate on both margins, and the outer seta of the second basipod segments is set on the tip of a hairy process. The end segment of the second endopod has one apical, one outer, and two inner setae; the end segment of the third endopod has two apical, one outer, and three inner setae; the end segment of the fourth endopod has three setae—one apical, one outer, and one inner. The basal segment of the fifth legs is broadly diamond-shaped, its pointed end reaching nearly to the tip of the distal segment, its inner expansion with four setae, placed some distance apart. The distal segment is twice as long as wide and pointed at its tip, with one apical filiform seta, quite elongate, one inner and three outer plumose setae, the last four very short and weak. Total length, 0.6–0.75 mm.

Male.—A little smaller than the female, and more cylindrical, especially the urosome. In the first legs the exopod has but two segments, the distal one longer than the proximal and armed with two setae and three spines; the second endopod segment carries an outer spine, the terminal claw is scarcely longer than the second segment. The second, third, and fourth endopods are more slender than those of the female, but the exopods are stouter, and their distal segment in all three pairs is turned inward nearly at right angles and armed with five long coarse spines. The outer spine of the middle segment of the third exopod is the same diameter throughout and is notched near its tip. None of the endopods show any of the usual sexual modifications found in this genus. The fifth legs are reduced to a narrow lamina, at whose outer end is the regular outer process of the basal segment, but the rest of the lamina shows no distinction of parts, being raised into four lobes, each tipped with a seta, the inner one shorter than the other three. Total length, 0.55–0.65 mm.

Remarks.—This species can be recognized by the two setae close together at the center of the outer margin of each caudal ramus, and by the details of the first and fifth legs. It is usually covered with small particles of débris, which cling to the hairs of the appendages and are difficult to remove.

LAOPHONTE HORRIDA Norman

FIGURE 173

Laophonte horrida NORMAN, Proc. Roy. Soc. London, vol. 25, no. 173, p. 206, 1876.—SARS, Crustacea of Norway, vol. 5, p. 246, pls. 166, 167, 1908.

Occurrence.—A single female was captured by C. H. Blake in a surface tow from the Bureau of Fisheries wharf at Woods Hole, August, 1925. This specimen was dissected and mounted by Mr. Blake, who kindly allowed the present author to examine the mount and to include the species here as belonging to the Woods Hole area.

Distribution.—British Isles (Norman, Brady); Greenland (Buchholz); Franz Josef Land (T. Scott); Polar islands (second Fram expedition); coast of Norway (Sars); Spitzbergen (T. Scott).

Color.—Dark yellowish brown, nearly uniform in shade and without pigment markings; eye a dull red or reddish brown.

Female.—Body segments separated by deep constrictions, the posterior corners of each segment angularly produced sidewise and backward; cephalic segment subquadrangular, the dorsal surface with a stout median spine near the posterior margin. The rest of the body, except the last two segments, with a row of smaller denticulate spines along each side of the dorsal midline, one spine on the posterior margin of each segment, including the median division of the genital segment. Rostrum tongue-shaped, constricted at its base, with an angular ledge at the center of each lateral margin, bearing a filiform seta. Penultimate abdominal segment with a row of four spines on its posterior margin, each tripartite at its tip. Caudal rami stout, three times as long as wide, apical setae about half the body length. First legs narrow and elongate, especially the basipod segments; exopod 2-segmented, scarcely more than one-third the length of the basal endopod segment. First antennae 6-segmented, the four basal segments five times as long as the two terminal segments; exopod of second antenna attached to the side of the basal endopod segment, 1-segmented, with four setae. Distal segment of fifth legs strongly constricted at its base, 3-lobed at its tip, each lobe with one seta, the inner one the longest. Basal expansion reaching beyond the tip of the distal segment, much narrowed at its tip, with one apical seta and three widely separated ones on its inner margin. Total length, 1.25–1.35 mm.

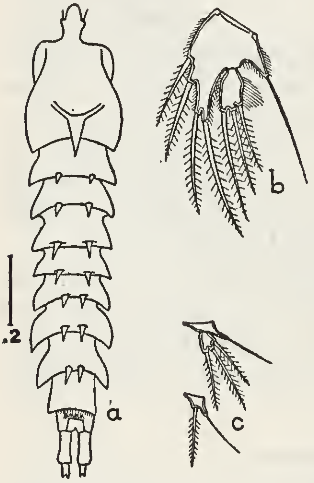

FIGURE 173.—*Laophonte horrida*: *a*, Female, dorsal; *b*, female, fifth leg; *c*, male, fifth and sixth legs

Male.—About the same length as the female, but more slender. First antennae enlarged, the fourth segment swollen posteriorly and with two or three anterior toothlike processes, the terminal segment ending in a sharp point. Exopod of third legs very wide and stout, its end segment twice the length of the second segment, with seven coarse spines, three apical, two outer, and two inner. Third endopod 3-segmented, the spine at the distal corner of the middle segment reaching the tip of the end segment. Distal segment of fifth legs very small, 3-lobed at its tip, each lobe with a seta; outer process of basal segment longer than distal segment, inner expansion obsolete, without setae; rudiments of sixth legs present. Total length, 1.25–1.35 mm.

Remarks.—This is one of the largest species of the genus and can be recognized at once by the longitudinal rows of dorsal spines and by the very large and peculiarly shaped rostrum. This is the first record of its occurrence on American shores.

Family MACROSETELLIDAE

Genus MACROSETELLA A. Scott, 1909

Body slender and cylindrical or slightly compressed; head fused with the first segment; urosome 4-segmented in female, 5-segmented in male; genital segment divided; caudal rami slender, cylindrical, longer than the last two abdominal segments combined, and closely appressed, apical setae much longer than the entire body.

First antennae 9-segmented, geniculate in the male; exopod of second antenna wholly lacking; exopods of first four pairs of legs 3-segmented, endopods of first legs 2-segmented, of the three following pairs 3-segmented in the female; in the male the second endopod is 2-segmented, the third and fourth endopods 3-segmented; fifth legs 2-segmented; a single ovisac.

KEY TO THE SPECIES (BOTH SEXES)

1. Frontal margin of head without cuticular lenses---------- gracilis (p. 281)
   Frontal margin of head with two cuticular lenses--------- oculata (p. 283)

MACROSETELLA GRACILIS (Dana)

FIGURE 174

Setella gracilis DANA, United States Exploring Expedition, 1838–1842 (Wilkes), vol. 14, Crustacea, p. 1198, 1853, pl. 84, fig. 3, 1855.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 559, pls. 1, 45, 1892.

Occurrence.—Ten specimens, including both sexes, were taken in a vertical net at Station 20049, *Grampus*, March 10, 1920; also reported from six other stations in the Gulf of Maine, most of them within the present area.

Distribution.—Mediterranean (Giesbrecht); Atlantic Ocean (Cleve); Malay Archipelago (A. Scott); Messina (Claus); Gulf of Guinea (T. Scott); Papua, Philippines, Sandwich Islands, Atlantic and Pacific (Brady); Indian Ocean (Thompson and Scott); North Sea (van Breemen); Gulf of Genoa (Brian); Gulf of Maine (Bigelow); Gulf Stream south of Marthas Vineyard (Wheeler).

Color.—Body in general very transparent; chitin covering and proximal portions of all the appendages pinkish violet; digestive canal ferruginous red, surrounded by oil drops, which are usually yellow and darker in color anteriorly; eye bright ruby red.

Female.—First antennae very long for an harpactid, reaching the genital segment; second antennae 3-segmented, the exopod entirely lacking; mandibles and maxillae very rudimentary; maxillipeds well developed, second segment much longer than the first, terminal claw less than half as long as the second segment. Rami of the swimming legs very narrow and elongate, those of the fourth pair reaching the abdomen. Basal expansion of fifth legs not reaching the center of the distal segment, with four apical setae, the second inner one plumose and more than twice the length of the others, which are smooth. Distal segment five times as long as wide, with three apical setae and three on the outer margin; the inner apical one the longest. Total length, 1.4–1.5 mm.

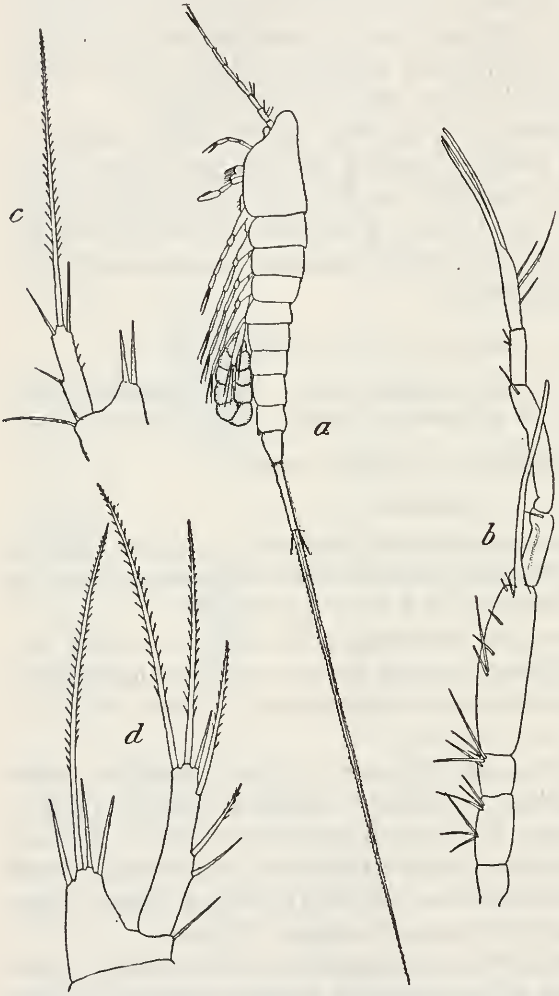

FIGURE 174.—*Macrosetella gracilis: a,* Female, lateral; *b,* male, first antenna; *c,* male, fifth leg; *d,* female, fifth leg. (From W. M. Wheeler)

Male.—First antennae geniculate, 8-segmented, the fourth segment greatly elongated and thickened, the distal aesthetask attached to the anterior margin of the end segment at its center. The first endopod is a little longer than the exopod, its basal segment almost twice the length of the distal segment, with scattered hairs along the inner margin and a spine at the distal corner. The second endopod only reaches the center of the second exopod segment, its distal segment longer than the basal segment, with one apical plumose seta, one inner filiform seta, and a group of three spines at the outer distal corner. Basal expansion of fifth legs very short and tipped with two setae; distal segment four times as long as wide, with three apical and one outer seta. Total length, 1.16–1.3 mm.

Remarks.—This is a pelagic species and belongs in tropical and warm temperate regions, only appearing as an immigrant within the present area. It can be recognized by the very long first antennae and apical caudal setae, the latter longer than the body itself.

MACROSETELLA OCULATA (G. O. Sars)

FIGURE 175

Setella oculata SARS, Bull. Inst. Océanogr., no. 323, p. 13, pl. 7, 1916.

Occurrence.—Six females and three males were taken in a vertical haul at Station 20076, *Grampus*, March 19, 1920.

Distribution.—Southern Pacific (Dana); Indian Ocean (Mrázek); Station 1696, Prince Albert de Monaco (Sars).

Color.—Eye a peculiar pale lavender; crown of head ultramarine blue; caudal rami orange-yellow, bases of the large apical setae bright Venetian red; the rest of the body pale yellowish and transparent. In the male the eye is much larger than in the female and deep crimson, while the body shows none of the blue, yellow, or red found in the female.

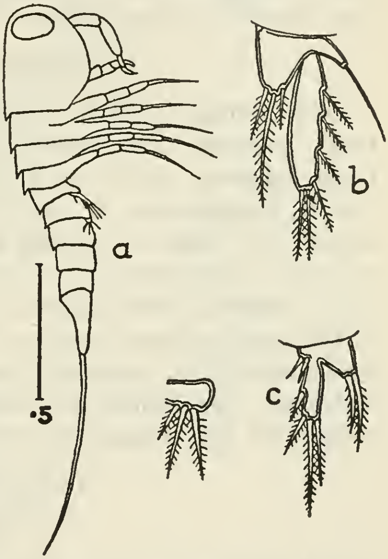

FIGURE 175.—*Macrosetella oculata:* a, Male, lateral; b, female, fifth leg; c, male, fifth and sixth legs

Female.—Body slender and tapered gradually backward, cephalic segment shorter than the rest of the metasome; rostrum long, pointed, and turned downward; front of head projecting a little, with a pair of cuticular lenses like those in the genus *Miracia.* Urosome as long as the metasome, its segments finely denticulate along their posterior margins; division of genital segment rather indistinct. Caudal rami somewhat flattened, much shorter than in the preceding species, their apical setae not so long as the body. Rami of the swimming legs very long and narrow, those of the fourth pair reaching the center of the penultimate abdominal segment. Basal expansion of fifth legs not reaching the proximal fourth of the distal segment, and armed with three setae; distal segment five times as long as wide, with three apical and three outer setae. Total length, 1.2–1.35 mm.

Male.—A little smaller than the female; first antennae considerably enlarged and prehensile; genital segment distinctly divided; caudal rami relatively longer than in the female, their apical setae scarcely half the body length. Second basipod of first leg with an acuminate spine at its inner distal corner; second endopod reaching the tip of the middle exopod segment, its end segment twice as long as the basal segment, with a short apical spine, two inner plumose setae, and a very short outer filiform seta. Basal expansion of fifth legs triangular, with two apical setae; distal segment with three apical and one outer setae; rudimentary sixth legs present at posterior corners of the genital segment. Total length, 1.15–1.3 mm.

Remarks.—This species can be recognized by the cuticular lenses on the front of the head and the long apical setae of the caudal rami. It is the same as Dana's *Miracia gracilis*, but, as Sars has shown, it can not belong to the genus *Miracia*, but is a true *Macrosetella*. The locality where the present specimens were obtained is not within the Woods Hole area, but is so near to it that the species is very likely to be found within the area in the future.

Genus MIRACIA Dana, 1846

Body elongate, slender, and tapered gradually backward; head fused with the first segment and laterally compressed, with two large cuticular lenses on the forehead; urosome 4-segmented in female, 5-segmented in male; genital segment distinctly divided; caudal rami long and slender, their apical setae scarcely longer than the rami. First antennae 8-segmented, geniculate in the male; exopod of second antenna small, 1-segmented, and attached to the side of the basal endopod segment. Exopods of first four pairs of legs 3-segmented, first endopod 2-segmented, second, third, and fourth endopods 3-segmented in female, second endopod 2-segmented in male; fifth legs 2-segmented and elongate. One species found here.

MIRACIA EFFERATA Dana

Figure 176

Miracia efferata Dana, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 53, 1849.—Brady, Voyage of H. M. S. *Challenger*, vol. 8, pt. 23, Copepoda, p. 102, pl. 43, figs. 1–16, 1883.

Occurrence.—One female from the trawl wings at Station 2235, *Albatross*, off Marthas Vineyard, September 13, 1884, by Rathbun; one female taken in a surface tow on Georges Bank, September 15, 1874.

Distribution.—North Atlantic and South Pacific (Brady); tropical Atlantic (Dana); Gulf Stream south of Marthas Vineyard (Wheeler).

Color.—The female is dark greenish blue, becoming yellowish along the margins of the segments; a large spot on the dorsal surface of the head, extending from the anterior margin back to the center of the cephalic segment, is blue above the eyes and black behind them. The entire dorsal surface of the body has a glistening metallic luster, deepest on the head and gradually fading posteriorly. The digestive canal is reddish yellow and surrounded with small red oil globules; the sides of the body are also more or less tinged with red and this color spreads onto the ventral surface of the genital segment and onto the ventral and dorsal surfaces of the penultimate abdominal segment. The basal segments of the first antennae are tinged with blue, the rest of these appendages, the mouth parts, the swimming legs, the anal segment, and the caudal rami are yellow. The eggs are blue at first and turn red as they mature. The male is much paler in color than the female. (Rathbun.)

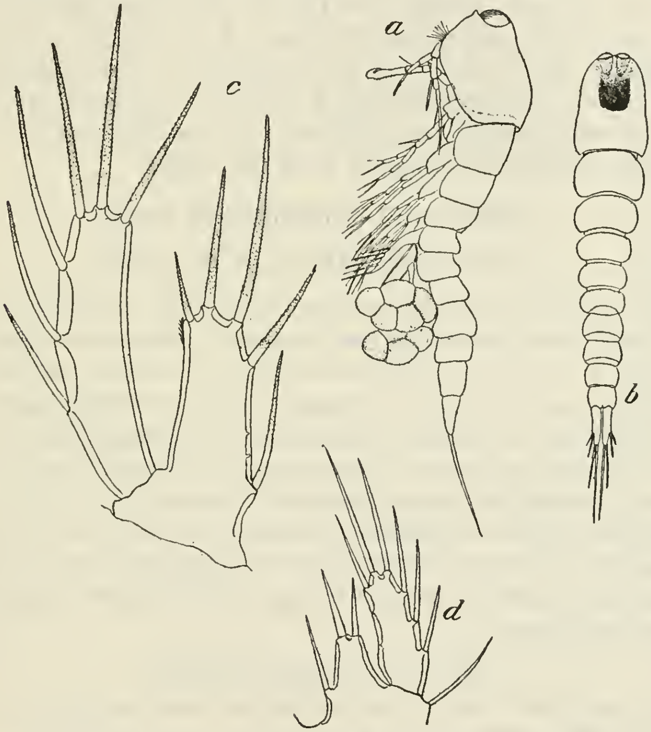

FIGURE 176.—*Miracia efferata: a,* Female, lateral; *b,* male, dorsal; *c,* female, fifth leg; *d,* male, fifth leg. (From W. M. Wheeler)

Female.—Urosome nearly as long as metasome, its segments not denticulate; caudal rami three times as long as wide, a little shorter than the last two abdominal segments combined. First antennae much shorter than the cephalic segment and slender. The second basipod of the first legs has on its inner margin near the distal end a small oval spot set with short bristles like a comb. Fifth legs foliaceous, the distal segment four times as long as wide, with three apical and three outer setae, all about the same length, nonplumose, but covered with minute knobs. Basal expansion reaching beyond the center of the distal segment, with three apical and two inner setae, the latter widely separated, and the five covered with knobs like those of the distal segment. Total length, 1.75–2 mm.

Male.—First antennae enlarged and prehensile, but not reaching the posterior margin of the cephalic segment. Endopod of the second as well as the first legs 2-segmented, its distal segment nearly three times as long as the proximal segment, with three apical and one inner setae. Fifth legs smaller than those of the female; distal segment twice as long as wide, with three apical setae and three on the outer margin. Basal expansion just reaching the center of the distal segment and narrowed at the tip, with two apical setae and one on the inner margin near the base. Total length, 1.4–1.6 mm.

Remarks.—This species can be recognized by the cuticular lenses on the front of the head combined with the very short caudal setae. It is evidently a pelagic harpactid and one that frequents the surface, and enters the present area only from the south.

Family CYLINDROPSYLLIDAE

Genus STENOCARIS G. O. Sars, 1909

Body slender and nearly uniform in width, 10 times as long as wide; head fused with the first segment; urosome as long as the metasome, 4-segmented in the female, 5-segmented in the male; genital segment partly divided in female, wholly divided in male; caudal rami divergent; two short, cylindrical ovisacs, eggs large in a single row. First antennae 6- or 7-segmented, the second segment much elongated; exopod of second antenna 1-segmented; exopods of first four pairs of legs 3-segmented, endopods of first and fourth legs 2-segmented, of second and third pairs 1-segmented in female, 2-segmented and modified in male; fifth leg a 1-segmented lamella without distinction of parts.

KEY TO THE SPECIES (BOTH SEXES)

1. Caudal rami three times as long as wide, the apical seta transformed into a lancet-shaped spine, bearing an outer bristle at its base -- **minor** (p. 286)
   Caudal rami as wide as long, each with 3 apical setae, which are unmodified ---------------------------------- **arenicola**, new species (p. 287)

STENOCARIS MINOR (T. Scott)

FIGURE 177

Cylindropsyllus minor T. SCOTT, 10th Ann. Rep. Fishery Board Scotland, pt. 3, p. 260, pl. 11, 1892.

Stenocaris minor SARS, Crustacea of Norway, vol. 5, p. 434, suppl. pl. 50, 1911.

Occurrence.—A few females were taken in the French Watering Place on Naushon Island, August, 1925.

Distribution.—Scottish coast (T. Scott); Norwegian coast (Sars).

Color.—Body as transparent and colorless as glass, becoming white in preservatives; no eye visible.

Female.—Body cylindrical, only slightly compressed; cephalic segment two-fifths of the metasome length; rostrum small and poorly defined; genital segment divided only at the sides; the three abdominal segments the same length; caudal rami as long as the anal segment, three times as long as wide; apical seta transformed into a lancet-shaped spine, a little longer than the ramus, with a filiform bristle issuing from its base on the outer side. Second segment of first antenna as long as the five following segments combined; basal endopod segment of second antenna divided, the exopod attached at the joint. Endopod of first legs as long as exopod, its basal segment with one inner seta, its end segment with three apical setae; endopod of fourth legs longer than the basal exopod segment and tipped with a single stout spine heavily fringed with cilia toward its tip. Each fifth leg a single lamina, as wide as long, with a coarse denticulate spine at the outer corner and seven setae around the distal end, the inner one the longest, the others very unequal in size. Total length, 0.8–1 mm.

Male.—Unknown.

Remarks.—This species may be recognized by its transparency, the peculiar apical setae on the caudal rami and the fifth legs. This is the first record of its occurrence in an American locality, and it is noteworthy that the specimens were taken in fresh water. Of this species females alone are known and of the following species only males, but the two are so different in size and in the details of the appendages that it is impossible for them to be the two sexes of the same species. Furthermore, the males were found in the open ocean where the water was of normal salinity.

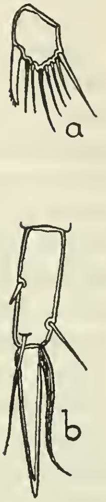

FIGURE 177.—*Stenocaris minor*: *a*, Female, fifth leg; *b*, female, caudal ramus

STENOCARIS ARENICOLA, new species

PLATE 17

Occurrence.—Two males were washed out of sand dredged off the bottom in 23 fathoms of water 12 miles south of No Mans Land. The male holotype is U.S.N.M. No. 63434.

Color.—Body transparent and colorless, without a trace of pigment; eye invisible.

Male.—Body slender and cylindrical, ten times as long as wide, the same diameter throughout; cephalic segment longer than the first two free segments combined and slightly widened anteriorly;

rostrum triangular and rather sharply pointed at its tip. Urosome nearly as long as the metasome; abdominal segments increasing in length posteriorly; caudal rami as wide as long and divergent, their inner margins semicircular, their outer margins nearly straight, each tipped with three setae, the middle one much longer than the other two, and an appendicular seta on the ventral surface.

First antennae 7-segmented, slender and twice geniculate at the third and fifth segments; fourth segment with a stout aesthetask, which is bent backward at its center. The last two segments of the antenna are turned forward, and since the aesthetask is nearly as wide as these segments, the antenna appears bifurcate at the fourth segment. Distal segment of second antenna with five apical setae, all the same length; exopod very slender, 1-segmented, attached to the side of the basal endopod segment and tipped with two minute setae. Second segment of maxilliped scarcely swollen at all, with smooth margins; terminal claw as long as the second segment, with a small bristle on its inner margin near the base.

Endopod of first legs just reaching the tip of the second exopod segment, its end segment a little longer than the basal segment and tipped with two unequal setae, the inner one twice the length of the outer. The second leg carries on the anterior surface of its second basipod a stout hooked claw or chela; the endopod does not quite reach the tip of the first exopod segment, is very slender, and the basal segment is twice the length of the distal segment, the latter having two unequal apical setae. The middle segment of the second exopod is much shorter than the other two segments and almost spherical; the end segment is turned inward at its center, and its single apical spine extends across the body at right angles. The fourth endopod only reaches the center of the basal exopod segment; its proximal segment is twice the length of the distal segment; the latter has a single apical seta, much longer than the whole ramus and plumose only at its tip. The two basal segments of the fourth exopod are elongated; the end segment is much shorter and carries three apical setae.

The fifth legs are very divergent, and each is made up of a single fused lamella, tipped with an exceptionally long seta; on the inner margin near the tip are five very short setae, the second one from the tip filiform; below these setae at about the center of the inner margin is a huge acuminate spine. Behind the fifth legs on the anterior portion of the genital segment is another pair of divergent lamellae, representing the sixth legs; each is armed on its outer margin with a short spine and at its apex with three slender setae, the inner one much shorter than the other two. Total length, 0.62 mm.

Remarks.—The short and wide caudal rami and the curious claws on the basipods of the second legs will identify the species. Its home appears to be within the sand at moderate depths, for which the extremely narrow and vermiform shape of its body seems well suited.

Genus PARASTENOCARIS Kessler, 1913

Body small, cylindrical and elongate, about the same diameter throughout; cephalic segment nearly as long as the first three free segments combined; urosome nearly as long as metasome; genital segment not divided; anal segment nearly twice as long as penultimate segment; caudal rami long and narrow, apical setae as long as urosome. First antennae 7-segmented, strongly geniculate in the male; exopod of second antennae 1-segmented, attached to the side of the basal endopod segment and tipped with a single seta; maxilliped well developed, with a stout terminal claw. Exopods of first, second, and fourth legs 3-segmented, of the third legs 2-segmented; endopod of first leg 2-segmented, of the three following pairs 1-segmented; third legs completely transformed in the male into a copulatory organ; endopod of fourth leg also modified; segments of fifth leg fused into a single lamella. One species known.

PARASTENOCARIS BREVIPES Kessler

FIGURE 178

Parastenocaris brevipes KESSLER, Zool. Anz., vol. 42, p. 310, 6 figs., 1913.

Occurrence.—Washed from the sand close to the shore of Nobska Fresh Pond and Waquoit Fresh Pond, Falmouth, August, 1927; abundant in both ponds.

Distribution.—Austria, fresh water (Kessler).

Color.—Body transparent and colorless, without pigment; eggs tinged with blue, increasing in color with development; eye invisible.

Female.—Epimeral parts of cephalic segment turned downward and inclosing the bases of the antennae and mouth parts; second (first free) segment longer than any of the following metasome segments. Urosome a little shorter than the metasome; genital segment not divided; anal segment almost as long as the two preceding segments combined; caudal rami four times as long as wide, swollen through the center, where each carries a transverse row of setae, terminal setae curved like parenthesis marks. Second segment of first antenna the longest, with three large setae along its dorsal midline nearer the distal end, and a fringe of short hairs on its anterior margin. First endopod as long as exopod, tipped with two elongate unequal setae; second and third endopods shorter than the basal exopod segment, the second one tipped with two very short spines and a filiform seta, the third one spiniform and minutely denticulate. Fourth endopod also spiniform, nearly as long as the entire exopod and ciliated at its tip. Fifth leg with the usual outer basal process, a broad spinelike inner expansion, unarmed, and between the two a short process carrying two setae and representing the distal segment. Total length, 0.4–0.5 mm.

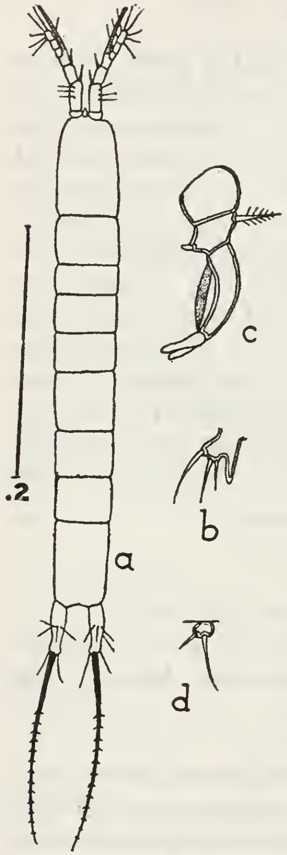

FIGURE 178.—*Parastenocaris brevipes: a,* Female, dorsal; *b,* female, fifth leg; *c, d,* male, third and fifth legs

Male.—As large as the female; first antennae geniculate, fourth segment enlarged, the three terminal segments folded back against its posterior surface. First and second legs like those of the female; third legs completely transformed and unlike anything found among harpactids. The rami of each leg are curved inward and completely fused except at the tip, where they are separated into two fingerlike processes, each of which ends in a hyaline membrane. The outer process is articulated with the fused portion and ends in a sharp point, the inner one is immovable and squarely truncated. The fourth endopod reaches nearly the tip of the second exopod segment and is obliquely truncated at its distal end and armed there with an outer rounded knob, an inner sharp point, and, between the two, five or six short setae. Inside of the endopod the distal corner of the second basipod projects as a rounded process bearing three apical fingerlike appendages. Each fifth leg is a tiny almost circular lamella, with two setae and without distinction of parts. Total length, 0.4–0.5 mm.

Remarks.—This is the first record of the species outside of Austria. Here in the ponds mentioned above it lives in the sand an inch or more beneath the surface and close to the water's edge. Every joint in the body seems capable of free motion, and it crawls about with the sinuous movements of an annelid. Its swimming is also more like that of a worm than of a copepod. It may be recognized by these movements, by the caudal rami and fifth legs of the female, and by the peculiar third legs of the male.

Genus D'ARCYTHOMPSONIA T. Scott, 1906

Body slender and subcylindrical, being somewhat compressed; head fused with the first segment and shorter than the rest of the metasome; rostrum small, not defined at its base. Urosome as long as, or longer than, the metasome; genital segment distinctly divided; abdomen 3-segmented, the segments equal in length; caudal rami small, each with a single elongated seta. First antennae 6- or 7-segmented; exopod of second antenna minute, 1-segmented; distal segment of endopod armed with coarse spines. Exopods of first four pairs of legs 3-segmented, endopods 2-segmented, the apical setae of both rami much elongated; the two segments of each fifth leg fused into a small lamina, with an outer process at the base, but no separation of distal segment and inner expansion. One species found here.

D'ARCYTHOMPSONIA PARVA, new species

PLATE 18

Occurrence.—Both sexes were obtained from one of the brackish ponds on Chappaquiddick Island, and a single female from another of the same ponds. One female has been chosen as the type of the new species and given U.S.N.M. No. 59761.

Color.—Body as transparent and colorless as glass with no trace of pigment; no eye visible.

Female.—Body subcylindrical, slightly compressed laterally, eight times as long as wide and tapered posteriorly. Head fused with the first segment, the resulting cephalothorax two-fifths as long as the metasome; rostral projection small and poorly defined at its base. Metasome passing insensibly into urosome; the latter, including the caudal rami, as long as the former; genital segment distinctly divided at about its center; the three abdominal segments about the same length and width; anal segment rounded on the ventral surface and abruptly depressed at the anal plate on the dorsal surface near its posterior end. Caudal rami twice as long as wide, swollen in the center and narrowed at either end, each tipped with a single stout seta two-thirds as long as the urosome, with a very short seta on either side; there are also several setae on the swollen central part of each ramus.

The first antennae are short, stout at the base, and regularly tapered, 6-segmented, rather sparsely setose; the fourth segment has a stout aesthetask reaching beyond the tip of the antenna. Second antenna stout, composed of three segments, the exopod replaced by a single spine on the ventral surface of the second segment; the end segment has a single long spine at its tip, four much shorter ones on the outer margin, and a single small one at the inner distal corner;

all these spines are coarse, irregular, and bluntly rounded at their tips. Mandibular palp minute and 1-segmented; second maxillae stout, with two lobes inside the terminal claw; maxillipeds so minute as to be easily overlooked, each made up of a vertical lamella, armed with a basal nodule and two curved claws.

The first four pairs of swimming legs have 2-segmented endopods, the segments about equal in length, and 3-segmented exopods, all the rami tipped with exceptionally long and slender setae. In the first legs each ramus has one such long seta, in the second and third legs two, while in the fourth legs the endopod has two and the exopod four, nearly four times the length of the exopod itself. The formulae of the spines and setae on these swimming legs are as follows: First exopod, 1–0, 1–0, 1–3; first endopod, 0–0, 0–2; second exopod, 1–0, 1–0, 1–3; second endopod, 0–0, 0–4; third exopod, 1–0, 1–0, 1–3; third endopod, 0–0, 0–4; fourth exopod, 1–0, 1–0, 1–4; fourth endopod, 0–1, 0–4. Each fifth leg consists of a small lamella with four setae, but without any distinction of parts except that the outer seta is on a knoblike projection removed from the others, which probably represents the outer process of the basal segment.

Male.—Body smaller than that of the female, but very similar in all its proportions. First antennae not geniculate; second antennae, mouth parts, and legs without any sexual modifications; fifth legs a simple lamella without the outer process and armed with four filiform setae; sixth leg rudiments present on the anterior half of the genital segment and consisting of a simple lamella smaller than that of the fifth legs and armed with three tiny hairs.

Remarks.—The glasslike transparency and consistency of this species are its chief characteristic, as well as the peculiar form of the end segment of the second antenna. During all the time the living copepods remained under observation they continued to lie on one side and did not assume an upright position at all.

Family TACHIDIIDAE

Genus CLYTEMNESTRA Dana, 1847

Metasome considerably depressed, all its segments, except the fifth, with angular projections at the posterior corners; urosome 4-segmented in female, 5-segmented in male; genital segment divided; anal segment as long as penultimate segment; caudal rami short and wide, apical setae scarcely as long as the rami. First antennae 7- or 8-segmented; exopod of second antennae degenerate, replaced by setae; first leg with 1-segmented exopod and 3-segmented endopod; both rami of second, third, and fourth legs 3-segmented; fifth legs 2-segmented, segments narrow and elongate. One species only.

CLYTEMNESTRA ROSTRATA (Brady)

FIGURE 179

Goniopsyllus rostratus BRADY, Voyage of H. M. S. *Challenger*, vol. 8, pt. 23, Copepoda, p. 107, pl. 42, figs. 9–16, 1883.

Clytemnestra rostrata GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 566, pl. 45, 1892.

Occurrence.—Two females were obtained from a vertical haul at Station 20044, *Grampus*, southeast of Nantucket.

Distribution.—South Atlantic (Brady); Red Sea, Indian Ocean (Thompson and Scott); California coast (Esterly); Mediterranean (Giesbrecht); Gulf of Guinea (T. Scott); Adriatic (Car, Graeffe, Steuer, Pesta); Gulf of Genoa (Brian); Gulf Stream south of Marthas Vineyard (Wheeler).

Color.—Body transparent and reddish, owing to a distribution throughout the body cavity of numerous small oil globules. Some of these are pale rose color, others pale ferruginous-red, and the remainder light green. The ovaries and eggs are dark gray with a reddish tinge; the eyes are deep carmine-red.

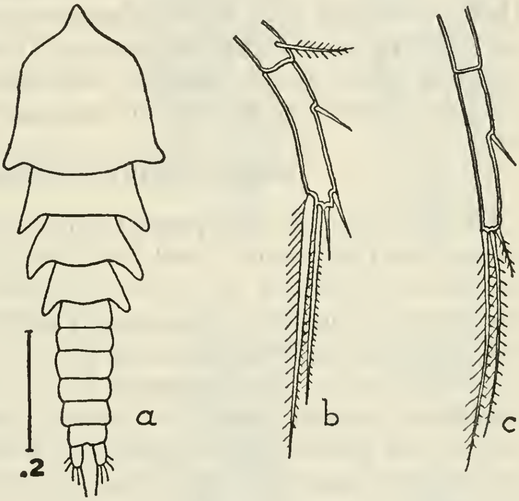

FIGURE 179.—*Clytemnestra rostrata: a,* Female, dorsal; *b,* female, fifth leg; *c,* male, fifth leg

Female.—Cephalic segment not much longer than wide, with prominent posterior corners; fifth segment much narrower than the fourth, with smoothly rounded sides; caudal rami as wide as long, the apical setae nonplumose and very short. First antennae 7-segmented and slender; exopod of second antenna replaced by a single seta, which is very elongate and is attached to the end of the basal endopod segment. Each first antenna carries six aesthetasks, two on the third segment, two on the fourth segment, and two at the tip of the sixth segment. Each fifth leg is as long as the exopod of the fourth leg, its distal segment three times as long as the basal, with two elongate apical setae, plumose on the inside, denticulate on the outside, and three much shorter nonplumose outer setae; basal segment with an outer seta representing the outer process; inner expansion entirely lacking. Total length, 0.5–0.87 mm.

Male.—Smaller than the female and not so much depressed; urosome longer and narrower; inner apical seta of caudal rami a little elongated. First antennae hinged between the last two segments, which are considerably elongated; three pairs of aesthetasks as in the female. Fifth legs like those of the female, but a little shorter and narrower, the distal segment only twice the length of the basal segment; a pair of minute finger processes, each tipped with a single seta, representing the sixth pair of legs, are found on the posterior margin of the genital segment. Total length, 0.4–0.7 mm.

Remarks.—This species is evidently pelagic rather than littoral, and is to be sought in the ocean to the south and the east of Woods Hole. Although it is widely distributed, as shown above, it does not seem to be abundant anywhere. It may be identified by the epimeral plates of the anterior metasome segments, by the very short apical setae on the caudal rami, and by the form of the fifth legs.

Genus TACHIDIUS Lilljeborg, 1853

Body short and subdepressed, the metasome much wider and longer than the urosome; head fused with the first segment; rostrum large but not defined at its base; urosome 4-segmented in female, 5-segmented in male; genital segment imperfectly divided in female, not divided in male; caudal rami short and wide, apical setae half the body length. First antennae 6- or 7-segmented, enlarged and subchelate in male; exopod of second antenna 2-segmented; rami of first four pairs of legs 3-segmented, second and third pairs modified in male; segments of fifth legs fused into a single wide lamella. One ovisac.

KEY TO THE SPECIES (BOTH SEXES)

1. Basal segment of first antenna divided posteriorly to its center; fifth legs with 4 setae in female, 3 in male ------------ littoralis (p. 294)
Basal segment of first antenna with only a shallow posterior notch; fifth legs with 9 setae in female, 7 in male ---- brevicornis (p. 296)

TACHIDIUS LITTORALIS Poppe

Figure 180

Tachidius littoralis Poppe, Abh. Nat. Ver. Bremen, vol. 7, pt. 2, p. 149, pl. 6, 1881.

Occurrence.—Found by Williams during April and May in the upper part of Narragansett Bay, Rhode Island.

Distribution.—Brackish pools, British Isles (Brady, T. Scott); Gulf of Suez (Thompson and Scott); on seaweed in Ems River, Germany (Poppe).

Color.—Unknown.

Female.—Body rather slender, the margins of all the segments and the surface of the abdominal segments with rows of fine hairs; fifth segment protruding dorsally, concave ventrally; caudal rami longer than wide, the inner apical seta twice as long as the outer. Basal segment of first antenna the longest, divided posteriorly nearly to its center; exopod of second antenna 2-segmented, its basal segment with one seta, its distal segment with three setae. Endopods of first four pairs of legs shorter than the exopods; distal segment of third endopod with six setae, of the other three endopods with five setae; fifth leg a 1-segmented lamina, curved inward at its tip, and armed with four plumose setae, the outer one the longest. Total length, 0.85–1 mm.

Male.—Slightly smaller than the female; the four basal segments of the first antennae regularly tapered, the fifth segment very short but wider than the fourth, the sixth segment swollen spherically on its posterior margin, the seventh segment transformed into a claw. Swimming legs like those of the female except the distal segment of the second endopod, which carries a small curved spine and only two terminal setae. Fifth legs each reduced to a short lamina fused with the ventral surface of the fifth segment and armed with three setae, of which the middle one is longer, the others shorter; rudiments of a sixth pair of legs are also present, each a small lamina with three setae. Total length, 0.8–0.9 mm.

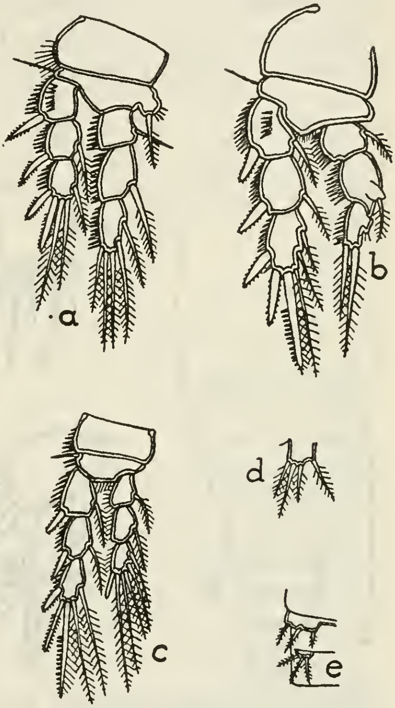

FIGURE 180.—*Tachidius littoralis: a, b, c,* Male, first, second, and fourth legs; *d,* female, fifth leg; *e,* male, fifth and sixth legs

Remarks.—This is a brackish-water species living close to the shore among the seaweed, and the best place to look for it within the present area will be in the brackish-water ponds, which are so numerous along the shores of Cape Cod and on the various islands. The deep cut in the basal segment of the first antennae and the structure of the fifth legs are the best characters.

TACHIDIUS BREVICORNIS Lilljeborg

FIGURE 181

Tachidius brevicornis LILLJEBORG, De crustaceis ex ordinibus tribus: Cladocera, Ostracoda et Copepoda, in Scania occurrentibus, p. 196, pls. 22–24, 1853.—SARS, Crustacea of Norway, vol. 5, p. 328, pls. 218, 219, 1909.

Occurrence.—Washed in considerable abundance out of the sand at Buzzards Bay bathing beach, Woods Hole, the sand on the shore of Katama Bay, Marthas Vineyard, and the sand of the surf beach on the south shore of Marthas Vineyard.

Distribution.—British Isles (Brady); Baltic (Lilljeborg); coast of France (Canu); coast of Norway (Sars); Finmark coast (T. Scott); Adriatic (Car, Carazzi, Pesta); Arctic Ocean (Willey); fresh-water pools, England (Gurney); Long Island Sound, N. Y. (Sharpe); Charlestown Pond, R. I. (Williams); Woods Hole Harbor (Fish).

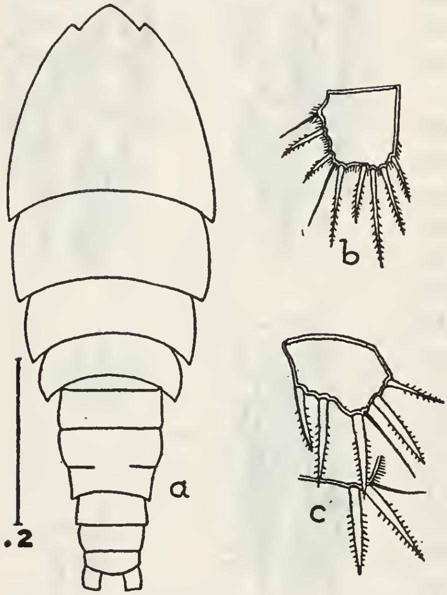

FIGURE 181.—*Tachidius brevicornis: a,* Female, dorsal; *b,* female, fifth legs; *c,* male, fifth and sixth legs

Color.—Body transparent with a decided whitish tinge, slightly colored irregularly with yellow and orange blotches; eye red; eggs yellow.

Female.—Body short and stout, metasome considerably depressed; urosome tapered posteriorly, not half the length of the metasome, its segments fringed along their posterior margins with spinules; caudal rami as wide as long, squarely truncated at the tip, apical seta half the length of the body. Basal segment of first antenna the largest, but not cut on its posterior margin; exopod of second antenna 2-segmented, basal segment with one seta, distal segment with two setae. Endopod of first legs longer than exopod, of the three following pairs of legs shorter, its distal segment in all four pairs with five setae. Each fifth leg a subquadrangular lamina with nine marginal setae, the first and fourth outer ones filiform, the fifth and seventh elongated. Total length, 0.5–0.7 mm.

Male.—Considerably smaller than the female, with a narrower urosome; the first antennae enlarged and subcheliform, the first segment with a wide dorsal flap projecting posteriorly and fringed with hairs, the second segment with a short posterior process, the fourth segment globularly inflated, the terminal segments transformed into a curved claw. Second and third legs stouter than in the female, the middle segment of the second endopod with a terminal acuminate spine; the third exopod with coarse outer and apical spines and reduced inner setae. Fifth legs partly fused across the midline, each with six or seven setae, the first and third outer ones filiform, the other plumose; sixth legs present, each with two stout inner plumose setae and a smaller outer filiform seta. Total length, 0.4–0.55 mm.

Remarks.—This species is often found in considerable abundance. Fish put it among the winter forms and said of it: "This was apparently the only harpactid that had a pelagic period during the year. Others may have been free-swimming, but did not occur in sufficient numbers to indicate it." Gurney has recorded this copepod as found in pools 6 miles or more from the ocean and filled with pure rain water.

RATHBUNULA, new genus

Body moderately elongate and somewhat depressed; metasome not much wider than urosome, but twice as long; epimeral portions well developed, covering the bases of the mouth parts and swimming legs. Head fused with the first segment; genital segment distinctly divided; caudal rami short and widely separated, apical setae half the body length or more. First antennae 6-segmented, profusely armed with pectinated spines and plumose setae, those of the male strongly hinged and subcheliform. Exopod of second antennae 3-segmented, long and stout, the middle segment short; mandibular palp biramose and well developed; maxilliped stout and uncinate, the terminal claw with accessory bristles. Rami of first four pairs of legs 3-segmented, all the spines pectinated; fifth legs 2-segmented, well armed with setae; rudiments of sixth legs present in the male. One large ovisac.

Genotype.—*Rathbunula agilis*, new species.

KEY TO THE SPECIES (BOTH SEXES)

1. Body slender, five times as long as wide; fifth segment half as long as wide; metasome segments separated by deep constrictions .... agilis, new species (p. 297)
   Body stout; only three times as long as wide; fifth segment four times as wide as long; metasome segments telescoped together .... curticauda, new species (p. 300)

RATHBUNULA AGILIS, new species

PLATE 19

Occurrence.—About 200 specimens, including both sexes and developmental stages, were washed from the sand of Buzzards Bay bathing beach at Woods Hole, July, 1927. The male holotype is U.S.N.M. No. 63435.

Color.—Body transparent and whitish, with a streak of carmine-red down the dorsal midline, beginning at the center of the cephalic segment and extending to the anus; contents of the digestive tube often yellow; eye deep carmine-red; eggs bluish, deepening in color with development.

Female.—Body somewhat fusiform, without a sharp distinction between the two divisions; cephalic segment widest across the posterior margin, much narrowed anteriorly. Rostrum narrow, quadrangular in outline, well defined at its base, and horizontal but turned downward at its tip. Second and third segments wider than the head, their width a little more than one-fifth of the body length. Epimeral plates well developed and projecting at the posterior corners of the metasome segments; fifth segment longer than the fourth and projecting ventrally. The four free segments are one-fourth longer than the cephalic segment plus the rostrum. The length of the urosome in comparison with the length of the metasome is in the proportion of 7 to 16. The two halves of the genital segment and the two basal abdominal segments have short rows of lateral spinules. The anal segment is shorter than the penultimate segment; the anal operculum and the posterior margin of the segment between the caudal rami are fringed with cilia. The caudal rami are almost three times as wide as long; each is produced at its inner distal corner into a conical process, armed with one long and two short setae, and there is a row of spinules across the tip of the ramus above the bases of the apical setae, of which the inner one is about half the body length.

First antennae 6-segmented, the basal segment fairly long, the second segment with two large doubly pectinated spines on its dorsal surface, the third segment with one at each distal corner, and the fourth segment with one at the anterior distal corner. The third and fourth segments are lobed on the anterior margin, and the former bears an elongated slender aesthetask and two very long filiform setae. The exopod of the second antenna is 3-segmented, the middle segment very short, with an inner seta, the other two segments much longer and equal; the basal segment bears two inner setae, the end segment four apical setae and a minute outer spine. The endopod is also 3-segmented, the basal segment very short, the end segment with five apical setae, the three inner ones geniculate, an inner apical spine, and a row of spinules along the inner margin, increasing in length distally. The exopod is attached to the side of the second endopod segment near its distal end.

The mandible has a chewing blade set with one large outer tooth and a row of 9 or 10 much smaller ones; the palp is made up of a basipod segment and two rami, the outer one 2-segmented, the inner one 1-segmented, the distal end of the basipod and both rami well armed with setae. First maxilla with its epipodal lobe shaped something like a dumb-bell, each end with three setae; second maxillae with three digitiform processes increasing in length outwardly. Basal segment of maxillipeds with two fingerlike processes and a seta at its inner corner, the second segment or hand with a fringe of long and fine hairs along its inner margin, one longer seta at the center and a shorter one near the distal end; the terminal claw is slender, curved at its tip, and jointed near its center, with two fine bristles on the inside at the joint.

In the swimming legs the spines of all the exopods are pectinated on their outer margins; the endopods of the first three pairs are longer than the exopods, the segments fringed on their outer margins with rather coarse spines; the rami of the fourth legs are about equal. The fifth legs are 2-segmented, the basal expansion broadly lamellar and a little longer than the distal segment, with six short apical setae, the inner one much smaller than the others, which are subequal. The inner margins of the basal expansions of the two legs are set with coarse spines which interlock on the midline; the outer process is stout and armed with one seta and several spines. The distal segment is ovate, with a fringe of hairs on its outer margin and six apical setae, the second and third inner ones terminal and borne on short processes; these two and the outer one are filiform, the other three plumose. Total length, 0.7–0.9 mm.

Male.—A little shorter and more slender than the female. In the first antennae the second and third segments are armed with doubly pectinated spines, the fourth segment is globularly swollen on its posterior margin, the fifth segment has a conical process at its posterior distal corner, and the end segment is claw-shaped with an accessory claw on its anterior margin. The second antennae, mouth parts, and swimming legs are like those of the female without sex modifications. The fifth legs are much reduced in size, especially the basal expansion, which scarcely reaches the center of the distal segment and bears only two setae; the distal segment is nearly as wide as long, somewhat ovate, with an outer fringe of long hairs and five apical setae, the middle one terminal, borne on a short process, and filiform. On the ventral surface of the anterior half of the genital segment is a short lamina on either side, armed with three setae, the outer one the longest; these laminae are the rudimentary sixth legs. Total length, 0.6–0.8 mm.

Remarks.—This was by far the most abundant copepod in the Buzzards Bay sand, and when once washed out into sea water it swam about vigorously like any free swimmer. The most persistent attempts, however, failed to secure any of them by towing in the ordinary manner above the sand. They may be easily recognized by the prominent rostrum and the profusely armed first antennae.

RATHBUNULA CURTICAUDA, new species

Plate 20

Occurrence.—Fifty specimens, including both sexes, were washed from the sand of Buzzards Bay bathing beach at Woods Hole, July, 1927. The male holotype is U.S.N.M. No. 63436.

Color.—Body transparent and colorless, but with a bluish tinge, and without the red streak on the dorsal midline, which is characteristic of the preceding species; eye red; eggs pale bluish.

Female.—Body fusiform and nearly as thick as wide, all the segments telescoped together, without intervening constrictions. Cephalic segment widest across the posterior margin, not narrowed anteriorly so much as in *agilis;* rostrum tongue-shaped, projecting in front of the first antennae, well defined at its base, and turned downward at its tip. Second and third segments wider than the head, the width about one-third of the body length; epimeral plates not well developed, but showing a little at the posterior corners of the segments. Fifth segment shorter than the fourth, and four times as wide as long; genital segment as long as the fourth and fifth segments together and only partly divided. Abdominal segments very short and wide, the two basal ones about the same length, the anal segment shorter, especially at the lateral margins. Caudal rami twice as wide as long, and separated by a space twice their own width, inner terminal seta two-thirds as long as the entire body.

First antennae curved into a semicircle, apparently 6-segmented but the jointing very indistinct, and even more profusely armed with setae and pectinated spines than *agilis.* The two basal segments of the exopod of the second antenna are the same length and each carries an inner pectinated seta; the end segment is twice as long, with two apical pectinated setae and a very long and slender inner seta, inserted at the base of the segment and plumose only at its tip. The mouth parts are like those of the preceding species except that the chewing blade of the mandible is more coarsely toothed. In the second legs the end segment of the exopod has no inner setae, and the end segment of the endopod has but a single inner seta.

The basal expansion of the fifth legs is fringed with hairs on both lateral margins, and the inner edges do not interlace on the midline; around the distal end are five mucronate setae of about the same size, which bear plumes only on their abruptly narrowed tips. The distal segment is small, reaching but little beyond the center of the basal expansion, with five apical setae, the inner one mucronate, the second inner one borne on a short process and, together with the outer one, filiform, the other two ordinary plumose setae. Total length, 0.4–0.5 mm.

Male.—A little smaller and more fusiform than the female; cephalic segment nearly half the body length; rostrum swollen at its base. First antennae much enlarged, the fourth segment almost spherical and turned outward at right angles to the basal segments. The genital segment is distinctly divided; the anal segment is almost twice the length of the penultimate segment, and the caudal rami are not so widely separated as in the female. The swimming legs show no sex modifications, but are like those of the female. The basal expansion of the fifth legs is much reduced and does not reach the center of the distal segment; it carries two small apical setae and three spines on its inner margin. The distal segment is as wide as long, with a fringe of hair on its outer margin and five apical setae, the outer one longer than the others and filiform. The sixth pair of legs is represented by a single seta on either side of the ventral surface of the genital segment. Total length, 0.35–0.45 mm.

Remarks.—This species can be recognized by its small size and stout appearance and by the wide separation of the caudal rami in the female, as well as the large size of the ovisac, which reaches beyond the tips of the apical setae of the caudal rami. It is not so abundant as the preceding species, but resembles it closely in its habits and is fully as active.

ECHINOCORNUS, new genus

Body somewhat depressed, metasome much wider than the urosome; head fused with the first segment and shorter than the rest of the metasome; rostrum large and prominent, well defined at its base. Urosome 2-segmented in female, 3-segmented in male; anal segment very highly vaulted dorsally, the anal operculum raised above the rest of the surface; caudal rami attached to the ventral surface of the anal segment, their apical setae half the body length. First antennae 6-segmented, profusely armed with setae and pectinated spines, strongly hinged in the male. Both rami of second antennae 3-segmented, the exopod attached to the side of the second endopod segment. Mandibular palp biramose; maxilliped with a stout terminal claw. Rami of first four pairs of legs 3-segmented, the exopods armed with wide, pectinated spines and fringed on their outer margins with spinules. Segments of fifth legs completely fused into a small lamella, the only part distinguishable being the outer process of the basal segment. A single large ovisac.

Genotype.—Echinocornus pectinatus, new species.

ECHINOCORNUS PECTINATUS, new species

Plate 21

Occurrence.—A dozen specimens, including both sexes, were washed out of the sand on Buzzards Bay bathing beach at Woods Hole, July, 1927 (male holotype, U.S.N.M. No. 63437); two females were also obtained from the sand on Nobska bathing beach.

Color.—Body transparent, with a faint bluish tinge; eggs a dark blue, becoming deeper with development; eye not visible.

Female.—Body widest through the cephalic segment, and quite strongly tapered backward, the epimeral plates showing plainly on the lateral margins and at the posterior corners of the segments. Genital segment shorter and narrower than the fifth segment, not divided; anal segment vaulted dorsally into a high ridge, which terminates posteriorly in the anal plate, fringed with spinules. The dorsal surface of the ridge is also covered with small spinules distally, and there is a row of spines on each lateral margin above the base of the caudal ramus. The ventral surface of the segment describes the arc of a circle in side view, turning upward posteriorly. The caudal rami are attached to the ventrolateral surface at each corner a little in front of the end of the segment. Each ramus is wider than long and covered with small spines on its dorsal surface and lateral margins. The outer terminal seta is one-third as long as the inner and both are sparsely plumose. On the dorsal surface of each ramus at the outer basal corner is a stout seta extending outward and upward.

Rostrum comparatively large and tongue-shaped, extending in front of the antennae and turned downward at its tip. The first antennae are profusely armed with setae and pectinated spines, and the segmentation is hopelessly indistinct, except at the tip. They are usually strongly hinged between the second and third segments, the distal part turned outward, and with the rostrum they form in front of the head a large letter T. The end segment of the endopod of the second antenna is the longest of the three segments, with a fringe of spinules on its inner margin increasing in length distally, the corner one pectinated; around the tip of the segment are five setae, all geniculate. The middle segment of the exopod is much shorter than either of the others and unarmed; the basal segment has an inner pectinated spine, and the end segment has two apical pectinated spines and an inner filiform seta.

The mandible has a narrow chewing blade, set with rather coarse teeth, and a biramose palp; the basal segment of the maxilliped carries a single large pectinated spine at its distal corner, the second segment is armed with two longitudinal rows of hairs and a long seta on the inner margin near the distal end, the terminal claw is stout and without accessory bristles.

The endopod of the first legs is longer than the exopod, its two basal segments unarmed except for an inner fringe of spinules, its distal segment with two apical pectinated spines and a filiform seta and two inner plumose setae. The middle segment of the first exopod is the only one with an inner seta, the end segment has one outer and three apical spines, the latter pectinated on the outer margin and plumose on the inner. The rami of the second, third, and fourth legs are about equal in length, all three segments of both rami carry inner setae, and the end segments are tipped with a pectinated spine and two plumose setae. The outer margins of both rami in the four pairs of legs are fringed with rather coarse spinules. The segments of each fifth leg are fused into a small lamina, separated into two lobes at the distal end by a deep incision, the narrower inner lobe representing the basal expansion and armed with three minute spines, the longer outer lobe representing the distal segment and armed with five small spines. A long filiform seta on the outer margin near its base represents the outer process of the basal segment. Total length, 0.38–0.42 mm.

Male.—A little larger and stouter than the female, the epimeral plates not so prominent at the posterior corners of the segments. Cephalic segment, excluding the rostrum, one-third the body length; rostrum wide and one-third the length of the cephalic segment. Urosome broad and 3-segmented; genital segment partially divided; anal segment one-half longer than the penultimate segment and highly vaulted as in the female; caudal rami twice as wide as long, with the usual armature; apical setae about half the body length.

First antennae considerably enlarged and strongly geniculate, with very obscure segmentation. The second and third segments much swollen and with the three terminal segments forming a regularly tapered cone, pointing diagonally backward and heavily armed with setae and pectinate spines. Second antennae, mouth parts, and swimming legs like those of the female without sexual modifications. The segments of each fifth leg are fused into a small semicircular lamina, which is not lobed as in the female but entire and armed with four plumose setae, the inner one very minute, the other three about equal. At the base of this lamina on the outside is a regular outer basal process, tipped with a filiform seta. The process points forward at first, then turns sharply in a half circle and points backward along the outer side of the lamina. Total length, 0.4–0.44 mm.

Remarks.—This species may be recognized by its small size, by the prominent epimeral plates in the female, by the large rostrum, and by the highly vaulted anal segment. It is much less common than either of the species of *Rathbunula*, and like them seems to be confined entirely to the beach sands.

Family PONTOSTRATIOTIDAE

Genus AEGISTHUS Giesbrecht, 1891

Body slender; head separated from the first segment, the forehead produced into a sharp, spinelike rostrum, which is immovable; urosome less than one-third the length of the metasome; genital segment divided; abdomen 3-segmented; caudal rami longer than wide, each with a single apical seta twice the length of the body, plumose only at its tip. First antennae 6- or 7-segmented; exopod of second antenna 1-segmented; rami of first four pairs of legs 3-segmented; fifth legs linear and indistinctly 2-segmented. Male unknown. One species found here.

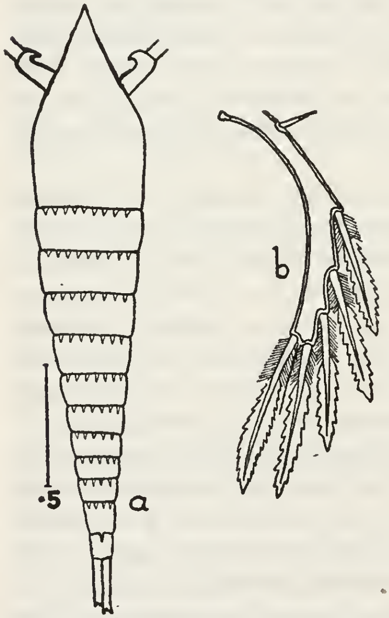

FIGURE 182.—*Aegisthus mucronatus; a*, Female, dorsal; *b*, female, fifth leg

AEGISTHUS MUCRONATUS Giesbrecht

FIGURE 182

Aegisthus mucronatus GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 573, pl. 46, figs. 46–49, 51; pl. 49, figs. 2, 3, 6, 10, 1892.

Occurrence.—A single female was obtained in a vertical haul at Station 20069, *Grampus*, March, 1920, southeast of Georges Bank.

Distribution. — Tropical Pacific (Giesbrecht); Gulf of Guinea (T. Scott); coast of Ireland (Pearson); North Sea (van Breemen); North Atlantic (Farran, Thompson); coast of South Africa (Cleve); Malay Archipelago (A. Scott).

Color.—Unknown.

Female.—Rostrum long narrow and acuminate; dorsal surface of metasome without a network of ridges; the last four metasome and all the urosome segments fringed on their posterior margins with stout spines; caudal rami attached to the ventral surface of the anal segment in front of its distal end; apical setae three and one-half times the length of the body. First antennae 6-segmented, the third segment bearing an aesthetask as long as the entire antenna; endopod of second antenna 4-segmented, the two basal segments very short; exopod short, 1-segmented, attached to the tip of the second endopod segment, with two apical setae. Two distal segments of both rami of first legs more or less fused; fifth leg indistinctly 2-segmented, the distal segment nearly four times the length of the basal segment, with five huge lancet-shaped setae, both margins of which are dentate; no basal expansion but an outer filiform seta representing the outer basal process; sixth legs present on genital segment. Total length, 2.2–2.3 mm.

Male.—Unknown.

Remarks.—This species can be distinguished by the exceptionally long caudal setae and by the remarkable setae on the fifth legs. It was reported for the first time from our American shore by the present author in Bigelow's Plankton of the Offshore Waters of the Gulf of Maine, Bulletin of the Bureau of Fisheries, volume 40, part 2 (p. 305), without comment.

Family METIDAE

Genus METIS Philippi, 1843

Body short and pear-shaped, much swollen; head fused with the first segment and considerably longer than the rest of the body; rostrum deflexed and not visible in dorsal view; urosome one-fourth the length of the metasome; genital segment imperfectly divided; caudal rami about as wide as long, inner apical setae three-fourths as long as the body. First antennae 5- to 7-segmented, the two basal segments more or less fused and produced distally into a beaklike process; second antennae tipped with coarse spines, the exopod obsolete; endopod of first legs 2-segmented, exopod and both rami of the three following pairs of legs 3-segmented; fifth legs rudimentary, more or less fused, and unlike in the two sexes. A single large ovisac.

KEY TO THE SPECIES

FEMALES

1. End segment of first exopod with 2 filiform setae and 2 coarse spines, all apical; endopod tipped with 2 coarse spines................ 2
   End segment of first exopod with 1 slender apical spine, 1 inner filiform seta, and 1 outer slender spine; endopod tipped with 2 setae................ natans (p. 306)
2. The two fifth legs fused on the midline at the base only, each with 2 small apical knobs tipped with a seta................ ignaea (p. 307)
   The two fifth legs fused for three-fourths of their length, each with 2 laminate apical lobes, without setae................ jousseaumei (p. 308)

MALES

1. End segment of first exopod with 2 plumose setae and 2 coarse spines, all apical; each fifth leg tipped with 2 short, stout spines................ 2

End segment of first exopod with 2 apical plumose setae and 1 slender outer spine; each fifth leg tipped with 3 short spines -- natans (p. 306)

2. Rostrum rounded at its tip, with a pair of subterminal setae; inner spine of end segment of first endopod curved and acuminate -- ignaea (p. 307)

Rostrum squarely truncated, with a pair of terminal juxtaposed spines; inner spine of first endopod straight and blunt -- jousseaumei (p. 308)

METIS NATANS (Williams)

FIGURE 183

Ilyopsyllus natans WILLIAMS, 37th Ann. Rep. Comm. Inland Fisheries Rhode Island, p. 73, pl. 1, 13 figs., 1907.

Occurrence.—Obtained by Rathbun in a surface tow from the end of a wharf at Newport, R. I., July 29, 1880.

Distribution.—Wickford and Charlestown Pond (Williams).

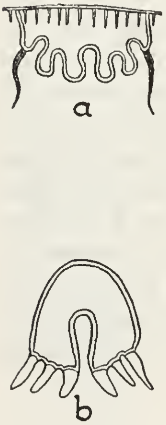

FIGURE 183.—*Metis natans: a,* Female, fifth leg; *b,* male, fifth leg

Color.—Body orange-red, becoming very deep and even brownish in some parts, in others changing to a straw yellow and becoming more transparent. All the segments except the cephalic appear banded, being deeper in color through the middle and becoming lighter anteriorly and posteriorly. The four posterior segments are nearly uniform in color; the internal organs show dark brown beneath the orange-red; the appendages are yellow. There are two irregular longitudinal series of blood-red dots running through the metasome on either side of the midline. The eye is very dark blood red, with three clear lenses, one on each side and one in front at the base of the rostrum. (Rathbun.)

Female.—Cephalic segment not so convex dorsally as in the two following species, but still strongly arched; rostrum large, thistle-shaped, and squarely truncated at the apex, where it carries two ciliated and movable spines, curved downward; caudal rami short and broad, the inner terminal seta as long as the body, its proximal half broadened and naked, its distal half abruptly tapered and fringed with short cilia on the outer margin. First antennae 6-segmented, the two basal segments well separated, the aesthetask on the third segment jointed twice near its base. Basal segment of second antenna longer than the second segment, the end segment with five apical setae and a spine on the dorsal surface near the base. Fifth legs fused across the midline, each 3-lobed, the lobes constricted at the base and bluntly rounded at the tip, the outer one only bearing a filiform seta. Total length, 0.45–0.5 mm.

Male.—A little smaller than the female; first antenna 8-segmented, with a long slender aesthetask on the third, and another on the fourth segment, the former jointed at its base as in the female, the latter not jointed. Second antennae and mouth parts the same as in the female; end segment of first exopod with two apical plumose setae and a slender spine on the outer margin; end segment of first endopod with one slender apical spine and a coarse, blunt spine, swollen at its center, on the inner margin. The two fifth legs fused into a U-shaped lamina, each arm of which carries three subequal apical spines, curved outward. Total length, 0.4–0.45 mm..

Remarks.—The female of this species may be recognized by the shape of the rostrum and the structure of the fifth legs, the male by the structure of the first and fifth legs. Williams's specimens were captured while swimming freely near the surface, but Rathbun obtained his material by washing the seaweed taken off the Newport wharf.

METIS IGNAEA Philippi

FIGURE 184

Metis ignaea PHILIPPI, Arch. Nat., Wiegmann, vol. 1, Jahrg. 9, p. 61, pl. 4, fig. 7, 1843.—SARS, Crustacea of Norway, vol. 5, p. 345, pl. 228, 1910.

Occurrence.—Taken near Chatham, October 26, 1915, at Station 10336, *Grampus*, in a surface tow.

Distribution.—British seas (Brady); coast of Norway (Sars); Mediterranean (Philippi, Brian).

Color.—Body a uniform fiery red, much brighter in hue than the two other species.

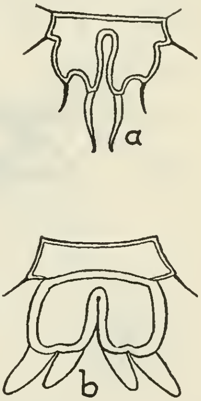

FIGURE 184.—*Metis ignaea*: *a*, Female, fifth leg; *b*, male, fifth leg

Female.—Cephalic segment very large, half the length of the body and strongly vaulted dorsally; rostrum tongue-shaped, deflexed, broadly rounded at the tip, with a pair of subterminal setae; urosome scarcely one-third the length of the metasome; caudal rami as wide as long, inner apical seta two-thirds as long as the body. First antennae 6-segmented, the two basal segments more or less fused, the aesthetask on the third segment jointed once near its base; basal segment of second antenna shorter than the second segment, the end segment with three coarse apical spines, two on the outer margin and one on the dorsal surface near the center. Fifth legs fused at the base only, each with two minute apical knoblike processes, armed with a single seta, and a third process on the outer margin near the base, tipped with a filiform seta. Total length, 0.5–0.6 mm.

Male.—Smaller than the female; first antenna prehensile, 8-segmented, the penultimate segment produced into a claw at its anterior distal corner, aesthetask on third segment not jointed. Endopod of first leg with two stout apical spines, the inner one curved and acuminate; end segment of first exopod with two filiform setae and two coarse spines, all apical; fifth legs fused at their base only, each with two short and blunt apical spines. Total length, 0.45–0.55 mm.

Remarks.—The details of the rostrum and the fifth legs will clearly separate this species from the other two here described. Sars said of it: "It generally occurs at moderate depths on a muddy bottom covered by decaying algae, and may at once be recognized by its vivid fiery red color."[8]

METIS JOUSSEAUMEI (Richard)

FIGURES 185, 186

Ilyopsyllus jousseaumei RICHARD, Bull. Soc. Zool. France, vol. 17, p. 69, 1892.

Occurrence.—Found in Great Harbor, Little Harbor, and the Eel Pond at Woods Hole, and in every one of the ponds from which collections were made along the south shore of Cape Cod, on Chappaquiddick Island, and on Marthas Vineyard; also in Cuttyhunk Harbor. The water in these ponds varied in salinity from a percentage equal to that of the ocean down to a mere trace, so that this copepod must be able to adapt itself to any salinity.

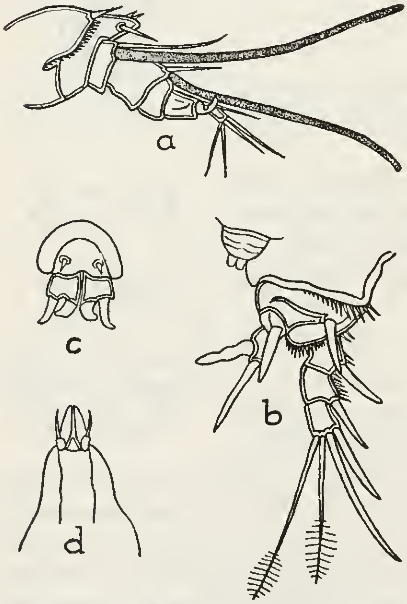

FIGURE 185.—*Metis jousseaumei: a,* Male, first antenna; *b,* male, first leg; *c,* male, fifth leg; *d,* male, rostrum

Distribution.—Gulf of Guinea (T. Scott); Gulf of Suez, Ceylon (Thompson and Scott); Malay Archipelago (A. Scott); Irish seas (Richard); Woods Hole (Sharpe).

Color.—In a collection of 250 specimens from Penzance Pond, Woods Hole, a few were found to be absolutely colorless and transparent, and the remainder showed every gradation through yellow, orange, pink, and light red up to a blood red so deep as to be almost black. But the blood-red specimens far outnumber all the other shades combined, and this must be taken as the real species color. None of the specimens showed any traces of the bright-red spots so characteristic of *natans*, but some of them did show the banding of color found in that species. Internal organs very dark, almost black.

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[8] Crustacea of Norway, vol. 5, p. 346, 1910.

Female.—Cephalic segment about half the length of the body; urosome less than half the length of the metasome, its segments fringed on their posterior margins with small spinules; rostrum large, triangular, squarely truncated, and tipped with two movable juxtaposed spines. First antennae 6-segmented, the two basal segments well separated, the aesthetask on the third segment more than three times the length of the last three segments combined, and twice jointed at its base, both joints bearing setae. Basal segment of second antenna shorter than the second segment, the end segment with six stout marginal spines. Terminal segment of first exopod with two filiform setae and two coarse spines, all apical; fifth legs fused across the midline into a single lamina, with a shallow median apical sinus. Each half has two laminate apical lobes, the inner one longer than the outer and sharply pointed. On the outer margin of each half is a filiform seta, representing the outer process of the basal segment. Total length, 0.35–0.5 mm.

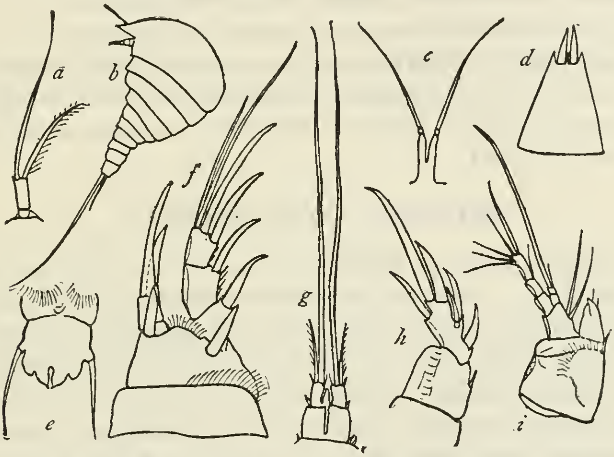

FIGURE 186.—*Metis jousseaumei:* *a*, Mandibular palp; *b*, female, lateral; *c*, maxillipeds; *d*, rostrum; *e*, female, fifth leg; *f*, female, first leg; *g*, caudal rami; *h*, female, second antenna; *i*, female, first antenna. (From R. W. Sharpe, Proc. U. S. Nat. Mus., vol. 38, p. 423)

Male.—Smaller and less swollen than the female; first antennae 8-segmented, prehensile, the two basal segments distinctly separated, the third and fourth segments each with a slender aesthetask, the seventh segment converted into a blunt claw. On each side of the ventral surface of the rostrum, beneath the base of the apical movable spine, is a slender seta with an enlarged bulbous base, and between the two bulbs on the midline is a small triangular process. The apical spines of the rostrum are smooth, shining, and blunt at their tips, which are in contact with each other. The terminal segment of the first endopod has a slender apical spine and a stouter one on the inner margin, nodular and blunt at its tip. Between the first legs on the midline is a rounded protuberance, tipped with two spherical processes in contact with each other. The three following pairs of legs are like those of the female; the fifth legs are fused into a lamina shaped like the letter **U**, each branch tipped with two stout and short spines, curved outward. There are no lateral setae, but instead a pair of minute spines on the surface of the lamina near the base of the **U**. Total length, 0.3–0.4 mm.

Remarks.—This species swims with a short jerky motion and usually sticks to the algae and débris, but is rarely captured in open water. It is often entirely covered with colonies of a ciliate belonging to the genus *Zoothamnium*, closely related to *Stentor*.

Gurney[9] has discussed at some length the synonymy of the different species in the genus *Metis* and has decided that Sharpe's species *sarsi* is a synonym of Richard's *jousseaumei*, and that Williams's species *natans* is valid. Both of these decisions appear to be correct and are here adopted.

Suborder CYCLOPOIDA

Fifth thoracic segment forming a movable articulation with the fourth, but firmly attached to the sixth segment. Metasome much wider than the urosome and more or less depressed. Eggs carried in two ovisacs, which are attached to the lateral or subdorsal surface, but never to the ventral surface as in the suborder Harpacticoida. Anterior antennae elongate and usually composed of a greater number of segments than those of the Harpacticoida, but not so great as those of the Calanoida. Posterior antennae generally simple, the exopod obsolete, the only exceptions being found in parasitic forms. First four pairs of swimming legs well developed, with stout segmented rami, the exceptions again being certain females of parasitic species. Fifth legs small and simple and alike in the two sexes.

Remarks.—This group includes species living in fresh, brackish, and salt water, and also comprises free swimmers, commensals, and parasites. As in the previous groups the number of segments in the rami of the swimming legs is not always the same for all the species of a given genus, and hence some genera appear twice or more in the key (Appendix B, p. 583). Owing to the presence of a movable joint between the fourth and fifth thoracic segments, the latter might be considered at first sight to be a part of the urosome. It seems far preferable, however, that the terms metasome and urosome should retain exactly the same significance in each of the various

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[9] Trans. Zool. Soc. London, pt. 4, 1927, pp. 567, 568.

copepod groups. Accordingly, the fifth thoracic segment is here regarded as belonging to the metasome, and the urosome includes only the genital and abdominal segments.

Family OITHONIDAE

Genus OITHONA Baird, 1843

Body slender, metasome moderately widened, urosome narrow, almost linear, 4-segmented in female, 5-segmented in male; head separated from first segment; rostrum sharp-pointed in female, lacking in male. First antenna 10- to 15-segmented; second antenna 2-segmented, the terminal segment at right angles to the basal. Rami of first four pairs of legs 3-segmented; outer exopod spines lacking on the middle segment of the second and third legs, and and on the two basal segments of the fourth leg; fifth leg a small conical segment with a long apical seta, another long seta on the side of the fifth segment in front of the leg.

KEY TO THE SPECIES (BOTH SEXES)

1. Rostrum directed forward and visible in dorsal view; first antennae reaching beyond genital segment________________________________ 2
   Rostrum turned downward and invisible in dorsal view; first antennae not reaching beyond genital segment__________________________ 3
2. Basipods of first 3 and fifth legs, second segment of first antenna, and caudal rami with bright-colored plumose setae____ plumifera (p. 311)
   These setae shorter and colorless, those on legs filiform, the others with minute plumes__________________________ spinirostris (p. 312)
3. End segments of first 4 exopods with 2, 1, 1, 1 in female, and in male, 2, 2, 2, and 2 outer spines, respectively_____________ similis (p. 314)
   End segments of first 4 exopods with 3, 3, 3, 2 in female, and in male 3, 3, 3, and 2 outer spines, respectively_________ brevicornis (p. 315)

OITHONA PLUMIFERA Baird

FIGURE 187

Oithona plumifera BAIRD, The Zoologist (Newman), vol. 1, p. 59, 1843.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 537, pls. 4, 34, 44, 1892.

Occurrence.—Two females were obtained in a surface tow south of Marthas Vineyard, July, 1881.

Distribution.—British seas (Baird); Mediterranean (Giesbrecht, Pesta, Thompson); North Atlantic (Cleve); California coast (Esterly); Malay Archipelago (A. Scott); North Sea, Arabian Sea (Cleve); tropical Atlantic (Dana); Red Sea, Indian Ocean (Thompson and Scott); Arctic Ocean (Mrázek); Adriatic (Car, Graeffe, Steuer, Pesta); Cape of Good Hope (Cleve); Narragansett Bay (Williams); Gulf Stream south of Marthas Vineyard (Wheeler); Gulf of Maine (Bigelow); Chesapeake Bay (Wilson).

Color.—Body very transparent, with ferruginous pigment variously distributed through the cephalic segment, especially in the region around the mouth. The same pigment sometimes forms spots symmetrically arranged in the thorax, the abdomen, the long setae of the first antennae, the furca, and the swimming legs. Other individuals are quite colorless except for the ruby-red eye.

Female.—Rostrum turned downward but at the same time extended forward far enough to render it visible in dorsal view; caudal rami shorter than the anal segment but three times as long as wide; setae on the outer margin and the tip of each ramus densely plumose and highly colored. First antennae reaching the anal segment; outer margin spines of the three exopod segments of the first four pairs of legs: 1, 1, 2; 1, 0, 2; 1, 0, 1; 0, 0, 1; respectively. The setae on the basipods of the second, third, and fourth legs and on the sides of the fifth metasome segment project at right angles to the body axis and are visible dorsally. Total length, 1–1.5 mm.

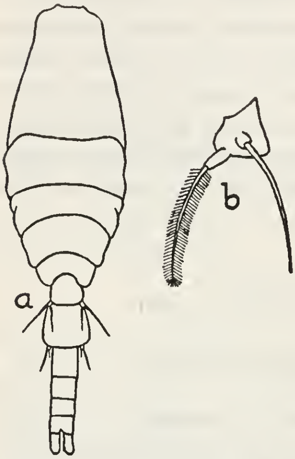

FIGURE 187.—*Oithona plumifera: a,* Male, dorsal; *b,* female, fifth leg

Male.—Rostrum lacking; second abdominal segment about as wide as long, anal segment the same length as each of the two preceding segments. First antennae twice geniculate; the first segment beyond the promixal elbow sheathing the base of the segment in front of it, the first segment beyond the distal elbow with a semicircular process on its inner margin. End segment of first and fourth exopods with two outer spines, of second and third exopods with three outer spines. Total length, 0.75–1 mm.

Remarks.—This species may be recognized by the long and highly colored plumose setae mentioned in the foregoing descriptions. It is apparently a pelagic species and chiefly tropical in its distribution, and comes into the area around Woods Hole as a straggler from the south.

OITHONA SPINIROSTRIS Claus

FIGURE 188

Oithona spinirostris CLAUS, Die frei lebenden Copepoden, p. 105, pl. 11, 1863.—SARS, Crustacea of Norway, vol. 6, p. 6, pls. 1, 2, 1913.

Occurrence.—Thirty specimens, including both sexes, were captured in a surface tow, March 19, 1920, southeast of Marthas Vineyard.

Distribution.—Mediterranean (Claus); North Atlantic (Farran); coast of Norway (Sars); Chesapeake Bay (Wilson).

Color.—Body very transparent and nearly colorless, but with a light orange tinge around the mouth and along the sides of the head. There is often a large oil bubble in the posterior part of the metasome and two smaller ones between the head and the first segment; eye orange-red.

Female.—Body slender, metasome fusiform; rostrum strong, spiniform, and nearly straight; no highly colored plumes; urosome about as long as metasome; genital segment dilated anteriorly; caudal rami as long as anal segment and divergent, the two middle apical setae twice as long as the urosome, with scattered plumes. First antennae reaching the second abdominal segment; spines on exopods of swimmings legs arranged as in *plumifera.* Ovisacs extending outward nearly at right angles to the body axis. Total length, 1.25–1.4 mm.

Male.—Much smaller and stouter than the female, the forehead obtusely truncated, without any trace of a rostrum; urosome less than three-fifths the length of the metasome; genital segment much enlarged; caudal rami shorter than the anal segment and parallel. First antennae twice geniculate, but without any trace of the sheath or the semicircular process found in *plumifera;* setae of fifth legs much shorter than in the female. Total length, 0.75–0.85 mm.

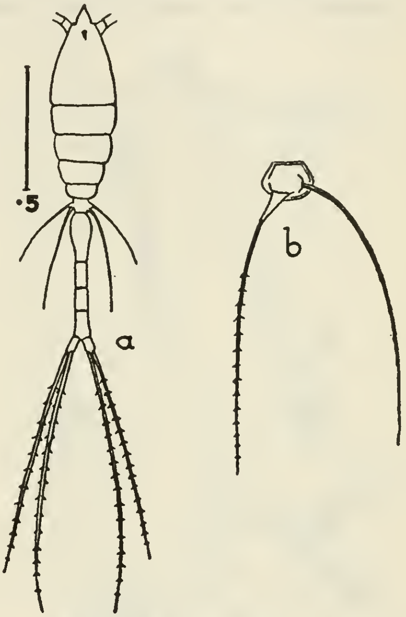

FIGURE 188.—*Oithona spinirostris: a,* Female, dorsal; *b,* female, fifth leg

Remarks.—Sars positively identified his Norwegian specimens with the species originally described by Claus. If this is correct, the new specific name *atlantica* proposed by Farran must yield precedence to the one first given to the species by Claus. Sars said of this copepod: "To judge from the structure of the oral parts, the animal must be of a very rapacious nature, probably feeding upon other small pelagic animals."[10]

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[10] Crustacea of Norway, vol. 6, p. 7, 1913.

OITHONA SIMILIS Claus

Figure 189

Oithona similis Claus, Die Copepodenfauna von Nizza, p. 14, 1866.—Sars, Crustacea of Norway, vol. 6, pp. 8, 207, pl. 3, 1913.

Occurrence.—Five hundred males and females were obtained in a vertical haul at Station 10323, *Grampus*, northeast of Cape Cod Light. A few specimens were obtained in Penzance Pond, Woods Hole, August, 1926.

Distribution.—Helgoland (Claus); Mediterranean (Giesbrecht); Adriatic (Car, Pesta); North Atlantic (Cleve); Polar seas (Mrázek, Boeck); Antarctic Ocean (Sars); Red Sea, Indian Ocean (Thompson and Scott); Skager Rak, Arabian Sea, Malay Archipelago (Cleve); British seas (Brady); Canary Islands (Thompson); coast of Norway (Sars); Bohuslän (Lilljeborg, Trybom); North Sea (Timm, van Breemen); Gulf of Maine (Bigelow); Narragansett Bay (Williams); Woods Hole Harbor (Wheeler, Fish); Chesapeake Bay (Wilson).

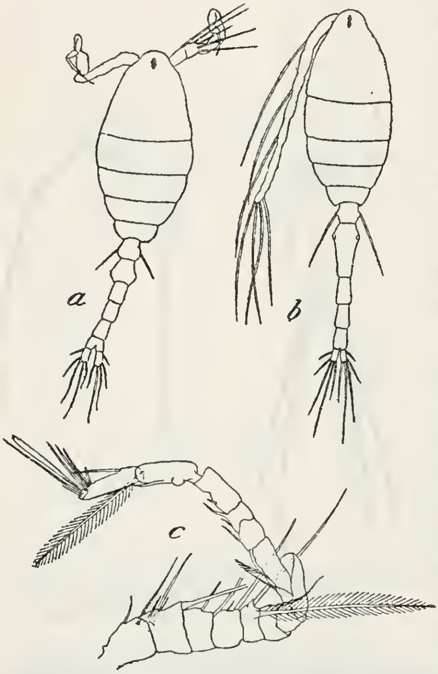

Figure 189.—*Oithona similis: a,* Male, dorsal; *b,* female, dorsal; *c,* male, first antenna. (From W. M. Wheeler)

Color.—Body transparent and often entirely colorless, but sometimes with ferruginous pigment scattered sparingly and irregularly through both metasome and urosome; eye deep red.

Female.—Body only moderately slender; rostrum turned downward so as to be invisible dorsally; urosome about three-fourths the length of the metasome; caudal rami much shorter than the anal segment and divergent. First antennae not reaching the genital segment; outer margin spines of the three exopod segments of the first four pairs of legs: 1, 1, 2; 1, 0, 1; 1, 0, 1; 0, 0, 0, respectively; ovisacs closely appressed to the sides of the urosome, each usually with a single row of very large eggs. Total length, 0.7–0.95 mm.

Male.—Rostrum entirely lacking; proportional lengths of the last three abdominal segments as 10:8:9; middle segment no longer than wide. First antennae twice geniculate, with a sheath just beyond the proximal elbow and a semicircular process on the first segment beyond the distal elbow as in *plumifera.* End segments of the first four exopods each with two outer margin spines. Total length, 0.6–0.7 mm.

Remarks.—This species may be distinguished by the number and arrangement of the outer spines on the swimming legs and by the ovisacs in the female. Unlike the previous species, this one is littoral and comes into the harbor and may even be found in tidal pools and salt ponds.

OITHONA BREVICORNIS Giesbrecht

FIGURE 190, *a*, *b*

Oithona brevicornis GIESBRECHT, Atti Accad. Lincei, Rome, ser. 4, vol. 7, p. 475, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, p. 538; pl. 34, 1892.

Occurrence.—Twenty-five males and females were obtained in Penzance Pond, Woods Hole, July, 1925.

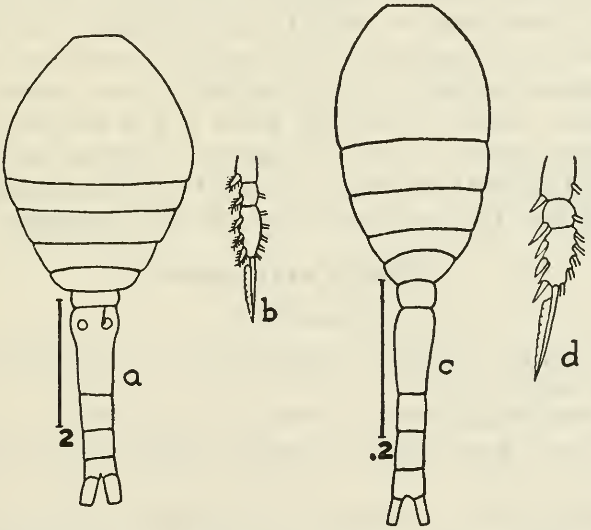

FIGURE 190.—*a, Oithona brevicornis,* female, dorsal (after Rosendorn); *b, O. brevicornis,* second exopod; *c, Oithonina nana,* female, dorsal (after Rosendorn); *d, O. nana,* second exopod

Distribution.—Hong Kong (Giesbrecht); tropical Atlantic (Cleve); Adriatic (Pesta); Chesapeake Bay (Wilson).

Color.—Body transparent without any pigment markings; eye reddish.

Female.—Rostrum short and turned downward so as to be invisible in dorsal view; caudal rami longer than the anal segment and at least three times as long as wide, the outer seta on each ramus three times as long as the ramus itself. First antennae not reaching the posterior margin of the third thoracic segment; outer margin spines on the three exopod segments of the first leg 1, 1, 3; of the fourth leg 1, 1, 2; of the second and third legs 1, 1, 3. Total length, 0.65–0.75 mm.

Male.—Unknown.

Remarks.—As might be inferred from the specific name, the best single character of this species is the reduced length of the first antennae. Another distinguishing mark is the three short outer spines on the end segment of the first exopod. This is evidently another littoral species that is likely to be found in the tidal pools and salt ponds of the area.

Genus OITHONINA G. O. Sars, 1913

Body slender, metasome moderately widened, urosome narrow, 4-segmented in female, 5-segmented in male; head separated from first segment and squarely truncated anteriorly; rostrum lacking in both sexes; caudal rami no longer than anal segment. First antennae 14-segmented, but segments often fused, not reaching beyond the third metasome segment, twice geniculate in male; second antennae 3-segmented. Rami of first four pairs of legs 3-segmented; outer exopod spine present on middle segment of second and third legs, and on the two basal segments of fourth legs; fifth leg with a single apical seta and none on the side of the fifth segment. A single species.

OITHONINA NANA (Giesbrecht)

FIGURE 190, *c*, *d*

Oithona nana GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 538, pls. 4, 34, 44, 1892.

Oithonina nana SARS, Crustacea of Norway, vol. 6, p. 5, 1913.

Occurrence.—Two females in surface tow in Buzzards Bay, July, 1926.

Distribution.—Bay of Naples (Giesbrecht); Red Sea, Arabian Sea, Indian Ocean (Thompson and Scott); Pacific coast (Esterly); Cape of Good Hope (Cleve); Black Sea (Krämer); Adriatic (Car, Steuer, Carazzi, Grandori, Pesta); Narragansett Bay (Williams).

Color.—Body not very transparent, irregularly mottled with yellowish green, especially in the posterior portion of the urosome and in the maxillipeds. The posterior part of the head usually contains on either side a little brownish-red pigment. Eye carmine-red; eggs yellowish green with red centers, both colors becoming darker as the eggs develop.

Female.—Body rather short and stout, metasome widened, forehead squarely truncated, rostrum entirely lacking, urosome linear; caudal rami as long as the anal segment, twice as long as wide. First antennae just reaching the posterior margin of the third metasome segment. Outer margin spines on the three exopod segments of the first three pairs of legs 1, 1, 3, respectively; on the fourth legs 1, 1, 2; fifth leg with a single apical seta and none on the side of the fifth segment. Total length, 0.5–0.65 mm.

Male.—Body shorter and stouter than in the female; groove between the first and second thoracic segments with a median dorsal sinus; no process on penultimate segment of first antenna; second abdominal segment longer than wide; length of last three abdominal segments as 10: 9: 6. End segment of exopod in first three pairs of legs with three outer spines, in fourth legs with two spines. Total length, 0.48–0.57 mm.

Remarks.—This species may be recognized at once by the squarely truncated forehead and the absence of a rostrum. Furthermore, the first antennae are shorter than in any of the other species. It is apparently a straggler into the area from the south and is not likely to occur in any great numbers.

Family CYCLOPINIDAE

Genus CYCLOPINA Claus, 1863

Body of usual cyclopoid form; urosome 4-segmented in female, 5-segmented in male. First antennae slender, 10-segmented in female, 14-segmented and twice geniculate in male; second antennae 4-segmented, without an exopod; mandibles with serrate teeth and a biramose palp; first maxillae with a well-developed masticatory lobe and a lamellar palp; second maxillae stout, the terminal part 3-segmented, the basal part 1-segmented; maxilliped rather slender, the distal portion made up of three sparsely setose segments. Rami of first four pairs of legs 3-segmented, the exopod spines broad and flanged, and numbering 6, 7, 7, and 5; fifth legs 2-segmented in both sexes, armed with spines and filiform setae; middle segment of first endopod with a single seta. Two ovisacs, subcylindrical; eggs large and few in number. A single species.

CYCLOPINA AGILIS, new species

PLATE 22

Occurrence.—Fifty specimens, including both sexes, most of the females carrying ovisacs, were washed from the sand on the shore of Katama Bay, Marthas Vineyard, August, 1927. The male holotype is U.S.N.M. No. 63438.

Color.—Body semitransparent, whitish, often tinged with blue; ovaries, oviducts, and eggs greenish blue; eye dull red.

Female.—Body cyclopoid, metasome elliptical, strongly arched dorsally, and flattened ventrally. Head fused with the first segment; rostrum bent downward and inward against the ventral surface, and hence invisible dorsally; cephalic segment almost twice the length of the rest of the metasome. Fourth and fifth segments strongly narrowed, the latter little more than half the width of the former. Urosome two-thirds the length of the metasome; genital segment as wide as the fifth segment anteriorly, then considerably narrowed. Abdomen 3-segmented, the two basal segments about equal in length, the anal segment longer. Caudal rami twice as long as wide, the inner terminal seta as long as the urosome, the outer seta attached to the center of the outer margin. Egg cases just reaching the end of the abdomen, cylindrical in form and each containing six or seven large eggs.

First antennae 10-segmented, the jointing more or less indistinct, and only half the length of the cephalic segment. Second antennae 4-segmented, the terminal segment tipped with six curved plumose setae, the penultimate segment with a tuft of short setae at the distal corner, the two basal segments with one seta each. Chewing blade of the mandibles with the outer tooth larger than the others, which diminish in size inwardly; palp biramose, inner ramus well developed, 2-segmented, outer ramus 4-segmented with weak setae. Second maxillae with a digitiform lobe attached to the end of the basal segment, and another on the second segment, the two terminal segments armed with setae. Maxillipeds made up of six segments, each of the three basal segments with a lobe on its inner margin armed with one or two setae, the terminal segment setiferous, the fourth and fifth segments without setae.

Rami of the swimming legs considerably widened, especially those of the first pair, the terminal segment of the endopods not much larger than the middle segment and armed in the first legs with four spines and three setae, in the other legs with five setae. The terminal segment of the exopods is both wider and longer than the middle and basal segments. In the first leg it is armed with four spines and four setae, in the second and third legs with five spines and three setae, and in the fourth leg with three spines and four setae. These spines increase in length distally, and each is made up of a stout central shaft, enlarged at its base, and wide smooth transparent flanges on both margins. The spines on the basal and middle exopod segments are like these on the end segments but smaller.

The fifth legs are 2-segmented, the segments about equal in length and in width, the basal one with a long seta at its outer distal corner, the terminal one with a stout inner spine, two outer spines, and a terminal filiform seta. These spines are not flanged like those on the preceding legs, but are perfectly smooth. The legs themselves extend outward diagonally or nearly at right angles to the body axis, and hence are usually visible in dorsal view. The outer seta on the basal segment reaches nearly to the tip of the apical seta on the end segment and is smooth, without plumes. Total length, 0.35–0.45 mm.

Male.—Body more slender and shorter than that of the female, the second, third, and fourth segments are but little narrowed, the fifth segment is abruptly contracted to half the width of the fourth segment. Urosome scarcely half the length of the metasome; genital segment widest posteriorly; abdomen made up of four segments about equal in length. First antennae very indistinctly segmented, apparently made up of 12 or 13 segments, powerfully developed and twice hinged, the proximal elbow very prominent, the terminal portion of two segments, the last one turned forward at right angles to the one preceding it. The third and fourth segments each carry a short spine on the posterior margin; the sixth segment, at the proximal elbow, has a triangular process on its outer margin, and at the base of the process on the dorsal surface are three stout setae. The second antennae, mouth parts, and swimming legs are like those of the female. The fifth legs are also similar, but the inner spine of the terminal segment is short and blunt, and the outer spines are longer and more slender; the apical seta is the same, elongate, and filiform. Total length, 0.3–0.4 mm.

Remarks.—This species may be recognized by the structure of the two pairs of antennae and the fifth legs. It is rather unusual to find a cyclopid in such a habitat, especially as no marine vegetation of any sort was present. But the large number of specimens obtained by washing a comparatively small quantity of sand leaves no doubt that this was their natural habitat. When disturbed the copepod darts about with great agility but quickly settles in another place, never remaining in motion for any length of time.

CYCLOPINODES, new genus

Body more elongate and narrower than in *Cyclopina;* urosome 4-segmented in female, 5-segmented in male. First antennae with 20 more or less distinct segments in female, 16-segmented and twice geniculate in male; second antennae 4-segmented, without an exopod. Mandibles with serrate teeth and a biramose palp; terminal section of second maxilla 3-segmented, basal section 2-segmented; maxilliped slender, its terminal section made up of four densely setose segments. Rami of first four pairs of legs 3-segmented, the exopod spines small and narrowly flanged, those on the end segments numbering 3, 4, 4, and 3, respectively; middle segment of first endopod with two setae; fifth leg 3-segmented in female, 4-segmented in male, armed with plumose setae only, no spines; sixth-leg rudiments present in the male. Two ovisacs, the eggs smaller and more numerous than in *Cyclopina.*

Genotype.—Cyclopinodes elegans (T. Scott).

Remarks.—This new genus is established for two species, both of which were referred by their authors to the genus *Cyclopina,* namely *Cyclopina elegans* T. Scott and *C. longicornis* Boeck. The accumulated differences noted above are sufficient to warrant the separation of the new genus. Two female copepods with 3-segmented fifth legs and evidently belonging to this new genus were washed from the sand on the shore of Katama Bay, Marthas Vineyard, but both were so badly mutilated as to render any description of them inadvisable.

Family CYCLOPIDAE

Genus HALICYCLOPS Norman, 1903

Body cyclopoid, the metasome considerably depressed; head fused with the first segment; rostrum turned downward against the ventral surface of the head, and hence invisible in dorsal view. Urosome 4-segmented in female, 5-segmented in male; anal segment shorter than the one preceding it; caudal rami twice as long as wide and somewhat divergent. First antennae short, 6-segmented, strongly geniculate in the male; second antennae 3-segmented, the exopod obsolete. Rami of the first four pairs of legs 3-segmented, considerably broadened and flattened; basal segment of fifth legs more or less fused with the fifth body segment, distal segment lamellar, with four or five plumose setae. One species found here.

HALICYCLOPS MAGNICEPS (Lilljeborg)

FIGURE 191

Cyclops magniceps LILLJEBORG, De crustaceis ex ordinibus tribus: Cladocera, Ostracoda et Copepoda, in Scania occurrentibus, p. 204, pl. 22, fig. 1, 1853.
Halicyclops magniceps SARS, Crustacea of Norway, vol. 6, p. 29, pl. 15, 1913.

Occurrence.—Female specimens were obtained from three of the brackish ponds on Chappaquiddick Island; Quisset Pond, Falmouth; the Mill Pond, Woods Hole; Great Pond, Falmouth; Ice Pond at Quisset; Poucha Pond, Chappaquiddick Island; Nashaquitsa Pond, Marthas Vineyard. Males were found with the females except in two of the brackish ponds and in the last three of the foregoing ponds.

Distribution.—Coast of Sweden (Lilljeborg); British Isles (Brady, T. Scott); coast of France (Canu); Algeria (Richard); Madeira (Fischer); coast of Norway (Sars); Poland (Landé); New Zealand (Thomson); Gulf of Mexico, Panama (Marsh).

Color.—Body only semitransparent, with an olive-green tinge; ovaries and oviducts dark blue and showing distinctly in both dorsal and ventral views; eggs grayish white, each with a light-brown center; eye reddish.

Female.—Cephalic segment considerably more than half the length of the metasome, second, third, and fourth segments narrowed regularly, with rounded epimeral plates, fifth segment abruptly reduced to half the width of the fourth segment and without plates. Urosome half the length of the metasome; caudal rami twice as long as wide and divergent. First antennae 6-segmented, the fourth segment longer than the fifth and sixth combined; terminal segments of the exopods of the first three pairs of legs with three outer spines, of the fourth legs with only two outer spines; second inner seta on distal segment of fifth legs filiform, the others plumose. Total length, 0.6–0.85 mm.

Male.—Much smaller than the female; first antennae twice geniculate, composed of at least 11 segments, some of which are very indistinctly defined. The middle section is only slightly swollen and the terminal section is sharply pointed. The first four pairs of legs are like those of the female; in the fifth legs the basal segment is more distinctly defined and the terminal segment is narrower, with longer and more slender setae. In all the males examined this segment had only four setae, all plumose, and one of these was apical. Sars said that this segment in the male differed from that in the female "by the presence of an additional seta attached inside the others."[11] In his figure of the male fifth leg he showed a filiform seta as apical; the males here recorded had no filiform seta on the fifth leg.

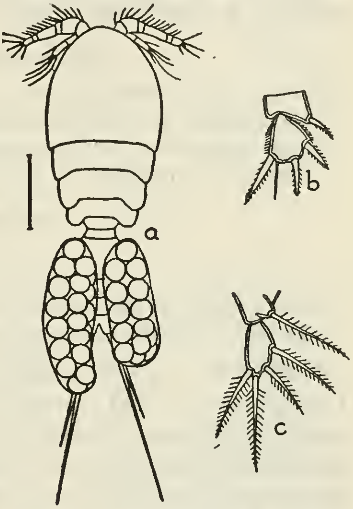

FIGURE 191.—*Halicyclops magniceps: a,* Female, dorsal; *b,* female, fifth leg; *c,* male, fifth leg

Remarks.—This is a brackish-water species. Marsh reported it as having been collected in Lake Pontchartrain, Louisiana, and added: "It seems likely that further collections in brackish waters will show that this is not an uncommon form."[12] The localities here given abundantly support that statement, and prove also that it is not confined to the Southern States.

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[11] Crustacea of Norway, vol. 6, p. 30, 1913.

[12] Trans. Wisconsin Acad. Sci., vol. 16, pt. 2, no. 3, p. 1106, 1910.

Genus CYCLOPS O. F. Müller, 1776

Metasome moderately widened and more or less depressed, considerably narrowed posteriorly; head fused with the first segment; lateral portions of metasome segments produced into angular epimeral plates, giving the margins of that part of the body a jagged appearance. Urosome slender; genital segment dilated anteriorly; caudal rami usually much longer than wide. First antennae 17-segmented, the number of segments sometimes reduced by fusion; second antennae 4-segmented without an exopod. Mandibular palp replaced by two or three setae; maxillary palp also rudimentary. Rami of first four pairs of legs 3-segmented, those of first and second pairs rarely less; fifth leg 2-segmented, end segment with a long apical seta and a short inner spine. Two subcylindrical ovisacs.

KEY TO THE SPECIES (BOTH SEXES)

1. Basal segment of fifth leg five times as wide as terminal segment; inner spine of latter extremely short---------------------- **viridis** (p. 322)
   Basal segment of fifth leg scarcely twice as wide as terminal segment; inner spine of latter long and setose------ **bicuspidatus** (p. 324)

CYCLOPS VIRIDIS (Jurine)

Figure 192

Cyclops vulgaris Koch, Deutschlands Crustaceen, Myriapoden und Arachniden, pt. 21, pl. 4, 1838.—Sars, Crustacea of Norway, vol. 6, p. 40, pl. 22, 1913.

Occurrence.—Both sexes found in moderate abundance in Salt Pond, Sidleys Pond, Oyster Pond, Flax Pond, and a small lily pond south of Ashumet Pond, all in Falmouth; in a small ice pond and Gosnold Upper Pond on Cuttyhunk Island; in a small pond near Chatham; in a small pond on Uncatena Island; in Hinckleys Pond, Harwich; in Jones pond, Waquoit Village; in Tarpaulin Cove Pond and West End Pond on Naushon Island.

Distribution.—Germany (Koch); Sweden (Lilljeborg); British Isles (Brady); Russia (Fischer); France (Richard); central Asia, Siberia, Norway lakes (Sars); United States (Marsh, Herrick, Forbes).

Color.—Very variable; sometimes light olive-gray, with scattered patches of dark brown along the posterior margins of the segments, forming a continuous band at the groove between the first two free thoracic segments. Again the head may be covered on the dorsal surface with small circular red spots, sparsely and irregularly scattered. The anterior and posterior ends of the digestive tract are often brick red while the median portion is blue. Eye dark blue; eggs bluish gray.

Female.—Body stout, metasome broadly oval, the second, third, and fourth segments projecting angularly at the posterior corners, the head and fifth segments rounded; urosome, including the caudal rami, about half the length of the metasome, the posterior margins of all its segments except the last serrate on the ventral surface; genital segment dilated anteriorly; caudal rami very variable in length, from one to four times the length of the anal segment, finely ciliated on their inner margins. First antennae 17-segmented, nearly reaching the posterior margin of the head. Rami of the first four pairs of legs 3-segmented, the end segments of the exopods in some specimens with 2, 3, 3, 3, spines; in other specimens with 3, 4, 4, 4 spines. Basal segment of fifth leg wider than long, with a plumose seta at its outer distal corner; distal segment short and narrow with a long apical seta and a very short inner spine. Semen receptacle made up of a short anterior transversely elliptical or heart-shaped portion in the center of the segment, and a posterior narrow band extending nearly across the segment. Total length, 1–2 mm.; rarely, 5 mm.

Male.—Metasome narrow oval, the greatest width (close to anterior margin of head) to the length as 3:7; cephalic segment longer than the rest of the metasome and broadly rounded anteriorly; fifth segment nearly as wide as the fourth and produced laterally into sharp angles; genital segment considerably swollen anteriorly and narrowed posteriorly; abdomen 4-segmented, first and fourth segments longer than second and third. First antennae twice hinged, the terminal portion made up of three segments, of which the one next the hinge is very short, while the middle one is elongated. The fourth, fifth, and sixth segments are very short and closely crowded, the ninth segment is abruptly widened, and the following segments taper gradually to the distal elbow. The second antennae, mouth parts, and swimming legs are like those of the female. In the fifth legs the distal segment is much wider but the setae and spine are the same; rudimentary sixth legs are present at the posterior corners of the genital segment. Total length, 0.8–1.5 mm.

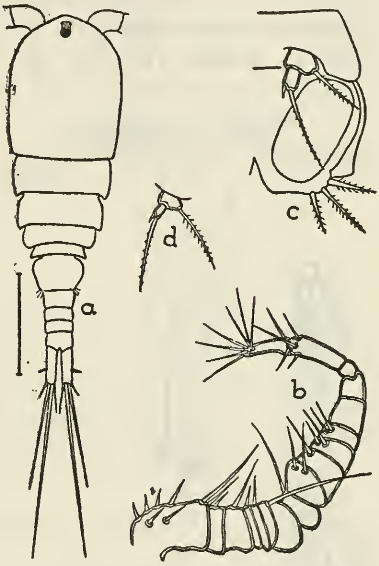

FIGURE 192.—*Cyclops viridis: a,* Male, dorsal; *b,* male, first antenna; *c,* male, fifth and sixth legs; *d,* female, fifth leg

Remarks.—Sars has substituted the name *vulgaris* given by Koch to this species for the varietal name *viridis* given by Jurine to one form of his species *Monoculus quadricornis.* American authors have regarded this as the most common form of *Cyclops* in temporary pools, and one of them has given in the American Naturalist (vol. 15, p. 736) an account of finding this copepod swarming in rain pools, filled overnight, near Salem, Iowa. The fifth legs furnish the best identification for this species.

CYCLOPS BICUSPIDATUS Claus

FIGURE 193

Cyclops bicuspidatus CLAUS, Arch. Nat., Wiegmann, vol. 1, Jahrg. 28, p. 209, pl. 11. 1857.

Cyclops pulchellus SARS, Crustacea of Norway, vol. 6, p. 47, pl. 27, 1913.

Occurrence.—Reported by Pearse from Nantucket Island in the American Naturalist (vol. 40, p. 248) and by E. B. Forbes from a pond in Woods Hole in the Bulletin of the Illinois State Laboratory of Natural History (vol. 5, p. 44).

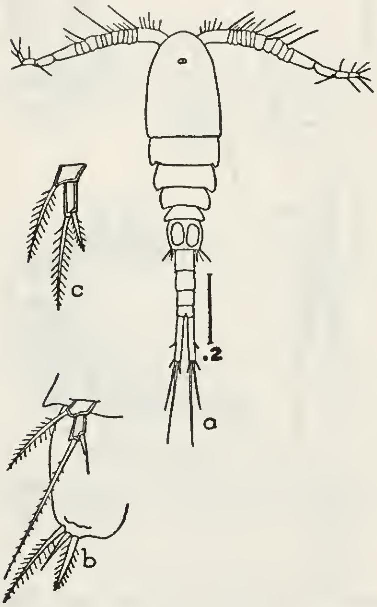

FIGURE 193.—*Cyclops bicuspidatus: a,* Male, dorsal; *b,* male, fifth and sixth legs; *c,* female, fifth leg

Distribution.—Germany (Claus) Europe, Asia, Norway (Sars); England (Pratt); North America (Herrick); Massachusetts (Forbes); Wisconsin lakes, Indiana (Marsh); Great Lakes (E. B. Forbes).

Color.—Body a light yellow, more or less tinged with orange or red; rarely a uniform whitish gray; eye reddish.

Female.—Body slender, metasome oblong, oval, width less than half the length; urosome less than half the length of the metasome; genital segment considerably widened anteriorly; the posterior margins of all the segments except the last serrate; caudal rami varying greatly, from two to eight times as long as wide, their inner margins usually ciliated, outer seta near the center of the ramus.

First antennae 17-segmented, reaching the posterior margin of the cephalic segment; rami of first four pairs of legs 3-segmented, end segments of exopods with 2, 3, 3, 3 spines. Fifth leg 2-segmented, basal segment as wide as long with one seta; distal segment twice as long as wide, the apical seta three times the length of the lateral one. Semen receptacle the shape of a bowl with a flaring rim and a convex cover, the sperm canals arising from the rim. Total length, 0.95–1.35 mm.

Male.—Body much more slender than in the female, four times as long as wide; cephalic segment one-third longer than the rest of the metasome, the other metasome segments with lateral epimeral plates. Urosome half as long as metasome; genital segment wider than long; abdominal segments diminishing in length distally; caudal rami as long as the three last segments combined, eight times as long as wide, the inner apical seta less than twice the length of the ramus.

First antennae 16-segmented, twice geniculate, the middle section scarcely swollen, the terminal section 3-segmented and nearly as long as the middle section; when reflexed these antennae reach the middle of the fourth metasome segment. The second antennae, mouth parts, and five pairs of legs are like those of the female; the two setae on the fifth legs are slender and very elongate, especially the apical one. There is a pair of rudimentary sixth legs at the posterior corners of the genital segment, each consisting of a short lamella armed with three setae, the outer one slender and elongate, the inner one shorter and broader, the middle one still shorter and nonplumose. Total length, 0.75–1 mm.

Remarks.—Birge and Juday have noted that in certain Wisconsin lakes this species is found during summer in a resting stage, inclosed in a cocoon of mud from which the copepod emerges in autumn. It is a common limnetic form of the Great Lakes, according to Marsh, and may be recognized by the position of the outer seta on the caudal rami, the elongated form of the rami themselves, and the 17-segmented first antennae.

Genus MICROCYCLOPS Claus, 1893

Body cyclopoid; metasome elliptical, twice as long as wide, fifth segment somewhat produced laterally; head fused with first segment. Urosome slender; genital segment scarcely dilated anteriorly; caudal rami longer than wide. First antennae 11- or 12-segmented; second antennae 4-segmented, without an exopod. Rami of first four pairs of legs 2-segmented, terminal segments much longer than the basal; fifth leg apparently 1-segmented, its basal segment entirely fused with the fifth metasome segment and represented by a lateral seta on the margin of the latter; terminal segment conical with a single apical seta, and sometimes an almost invisible inner spine. Two ovisacs; eggs large and few in number.

KEY TO THE SPECIES (BOTH SEXES)

1. First antennae 12-segmented; caudal setae very unequal and one-half longer than the urosome________________________ varicans (p. 326)
First antennae 11-segmented; caudal setae subequal and a little shorter than the urosome________________________________ bicolor (p. 327)

MICROCYCLOPS VARICANS (G. O. Sars)

Figure 194

Cyclops varicans Sars, Forh. Vid.-Selsk. Christiania, 1862, p. 252; Crustacea of Norway, vol. 6, p. 54, pl. 33, 1913.
Microcyclops varicans Kiefer, Das Tierreich, Lief. 53, p. 86, 1929.

Occurrence.—Both sexes found in abundance in three of the brackish ponds on Chappaquiddick Island and in Poucha Pond on the other side of the same island; in Quisset and Crockers Ponds, Falmouth, and in Farm Pond, Marthas Vineyard.

Distribution.—Norway (Sars); Sweden (Lilljeborg); Germany (Schmeil); Turkestan (van Douwe, Uljanin); Poland (Landé); Africa, New Zealand (Sars); Lake Albert Nyanza (Cunnington); British Isles (Scourfield); Russia (Matile); Scottish Lakes (T. Scott); Switzerland (Graeter); Illinois River (E. B. Forbes); Nantucket Island (Pearse).

Color.—Body transparent, anterior portion colorless, but the longitudinal muscles are pale yellow and the digestive tract is reddish, posterior portion yellow, the digestive tract again reddish. Eye ruby red, the lenses colorless and scintillating; eggs pale bluish green, the color persisting in formalin.

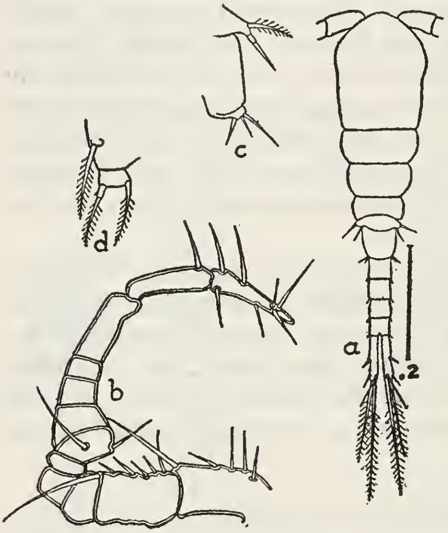

Figure 194.—*Microcyclops varicans: a,* Male, dorsal; *b,* male, first antenna; *c,* male, fifth and sixth legs; *d,* female, fifth leg (variant)

Female.—Metasome oval, a little more than half as wide as long, the fifth segment produced a little laterally; urosome more than half as long as the metasome; genital segment widened anteriorly, narrowed posteriorly; caudal rami as long as the last two abdominal segments, outer seta somewhat removed from the tip of the ramus. First antennae 12-segmented, not so long as the cephalic segment; rami of first four pairs of legs 2-segmented, spines and setae on the end segment of the exopods as follows: 3, 5; 4, 5; 4, 5; 3, 5. Basal segment of fifth leg fused with the fifth metasome segment, its presence indicated by a plumose seta; rarely the segment is distinctly separated. Distal segment small and conical with a single apical seta. Seminal receptacle small, longitudinally elliptical in the center, contracted into a narrow band on either side. Total length, 0.7–0.9 mm.

Male.—Body much more slender than that of the female; metasome an elongated oval, the greatest width (near the anterior end) to the length as 6:15. Cephalic segment evenly rounded in front and a little longer than the rest of the metasome; fifth segment produced laterally as in the female. Urosome less than half the length of the metasome; genital segment but little swollen. The four abdominal segments are about the same width but diminish slightly in length backward. Caudal rami longer than the last two segments combined, five times as long as wide, the outer seta near the center.

First antennae twice hinged, at the fifth and tenth segments, the terminal portion composed of two elongated segments, the sixth and seventh segments abruptly swollen to nearly twice the diameter of the adjacent segments; very similar to some of the genera in the Calanoida. Second antennae, mouth parts, and swimming legs like those of the female; basal segment of fifth leg always fused with the body. A sixth pair of legs is present at the posterior corners of the genital segment, projecting far enough to be partially visible in dorsal view. Total length, 0.5–0.66 mm.

Remarks.—The reddish color of the digestive tract was probably due to the food eaten, a small spherical red diatom, which was very abundant in the ponds where this copepod was found. Most of the specimens were covered with a growth of hairy algae, often dense enough to form a long fur effectively concealing structural details. This species may be recognized by the combination of 12-segmented first antennae and 2-segmented rami of the swimming legs.

MICROCYCLOPS BICOLOR (G. O. Sars)

FIGURE 195

Cyclops bicolor SARS, Forh. Vid.-Selsk. Christiania, p. 253, 1862; Crustacea of Norway, vol. 6, p. 56, pl. 34, 1913.
Microcyclops bicolor KIEFER, Das Tierreich, Lief. 53, p. 70, 1929.

Occurrence.—Found in small numbers in Crockers Pond, Falmouth, Farm Pond, Marthas Vineyard, and a weedy pond near Chatham.

Distribution.—Sweden (Lilljeborg); Germany (Schmeil); Norway (Sars); Hungary (Daday); Poland (Landé); France (Richard); Wyoming, Illinois, Wisconsin, Michigan, Minnesota (E. B. Forbes, Marsh, Herrick).

Color.—Metasome transparent and colorless, urosome a golden yellow or bright orange, deepest near the anterior and posterior margins of the segments. First antennae and mouth parts also yellow or orange in whole or in part; eye red and close to the anterior margin of the head.

Female.—Metasome oval, a little more than half as wide as long; fifth segment not produced laterally; urosome two-thirds as long as the metasome; genital segment only slightly widened anteriorly, but quite protuberant on the ventral surface. Caudal rami as long as the last two abdominal segments, outer seta near the tip of the ramus. First antennae 11-segmented, scarcely half the length of the cephalic segment, the basal segments enlarged more than in *varicans.* Rami of first four pairs of legs 2-segmented, fourth pair smaller than the others, the outer apical spine of its endopod very small and rudimentary. Basal segment of fifth leg entirely fused with the body, distal segment very small and tipped with a filiform seta without any trace of a lateral spine. Semen receptacle transversely elliptical and occupying nearly the entire width of the genital segment. Total length, 0.5–0.8 mm.

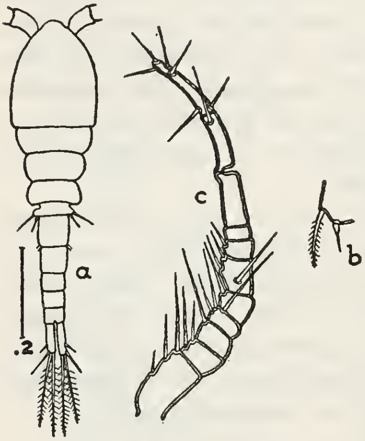

FIGURE 195.—*Microcyclops bicolor: a,* Male, dorsal; *b,* male, fifth leg; *c,* male, first antenna

Male.—Body more slender than in the female; cephalic segment not so long as the rest of the metasome; fifth segment produced laterally; urosome more than three-fifths as long as the metasome; genital segment with straight lateral margins; the four abdominal segments diminishing both in width and length backward; caudal rami as long as the last two segments combined, four times as long as wide, the outer seta near the tip. As in the female, the two apical setae are subequal and much shorter than the urosome. First antennae 11-segmented, not strongly hinged, the terminal portion composed of two elongated segments, the end segment distinctly longer than the preceding segment, the two combined longer than the middle section of the antenna; sixth and seventh segments not swollen. Second antennae, mouth parts, and swimming legs like those of the female; fifth legs also the same; sixth legs represented by two setae at each posterior corner of the genital segment. Total length, 0.4–0.7 mm.

Remarks.—This species may be recognized by the 2-segmented rami of the swimming legs, the 11-segmented first antennae, and the subequal apical setae on the caudal rami. When alive it can be picked out at once by its peculiar color. It is widely distributed but does not seem to be abundant anywhere.

Genus ORTHOCYCLOPS E. B. Forbes, 1897

Body rather slender; metasome elongate, twice as long as wide and but little depressed; urosome cylindrical, 4-segmented in female, 5-segmented in male; genital segment widened but little; caudal rami longer than anal segment. First antennae 16-segmented in both sexes, twice geniculate in the male, the terminal section as long as either of the other two, the eleventh segment with a process at the anterior distal corner; second antennae 4-segmented, without an exopod. Rami of first four pairs of legs 3-segmented; fifth leg also 3-segmented, the basal segment unarmed, the second segment with one outer seta, the end segment with two very long subequal setae. Two ovisacs; eggs of moderate size. A single species.

ORTHOCYCLOPS MODESTUS (Herrick)

FIGURE 196

Cyclops modestus HERRICK, Amer. Nat., vol. 17, p. 500, 1883; Copepoda of Minnesota, p. 108, pl. 21, figs. 1–5, 1895.

Orthocyclops modestus E. B. FORBES, Bull. Illinois Lab. Nat. Hist., vol. 5, p. 51, pl. 15, fig. 4, pl. 16, figs. 1–3, 1897.

Occurrence.—A few specimens were taken in Gosnold Upper Pond on Cuttyhunk Island, July, 1926.

Distribution.—Alabama, Minnesota (Herrick); Wisconsin, Pennsylvania (Marsh); Wyoming (Forbes).

Color.—Body rather transparent with a decided violet or purplish tinge, especially along the grooves between the segments, the metasome with a peculiar shining surface as though polished.

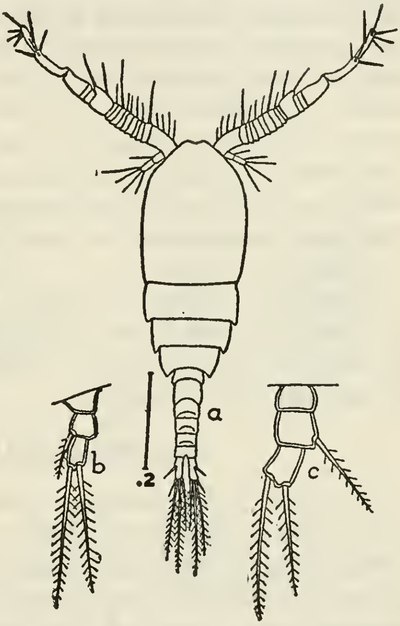

FIGURE 196.—*Orthocyclops modestus: a*, Male, dorsal; *b*, male, fifth leg; *c*, female, fifth leg

Female.—Metasome broadly oval, the breadth exceeding half the length; urosome, including the caudal rami, about half the length of the metasome; cephalic segment one-half longer than the rest of the metasome; genital segment longer than the two basal segments of the abdomen, with rounded lateral protuberances near its anterior end; caudal rami three times as long as wide, ciliate on their inner margins. First antennae 16-segmented, longer than the cephalic segment; rami of the first four pairs of legs 3-segmented, the terminal exopod segments with 4, 4, 3, 3, spines, an unusual combination; fifth legs 3-segmented, basal segment short and unarmed, second segment with one outer seta, third segment with two subequal elongate apical setae. Total length, 1.2–1.3 mm.

Male.—Body relatively stout, cephalic segment broad, its width to its length as 7:10, narrowed and slightly emarginate anteriorly and rather squarely truncated posteriorly; second, third, and fourth segments wide and produced at their posterior corners; fifth segment abruptly narrowed to half the width of the fourth. Urosome, including the caudal rami, less than half the length of the metasome; genital segment about the same width as the fifth segment, with convex sides. Abdomen 4-segmented, the segments diminishing in length but not in width backward; caudal rami two and a half times as long as wide, the outer seta at the center of the outer margin; three terminal setae, the middle one the longest and longer than the urosome plus the caudal rami. First antennae 16-segmented, but some of the joints are very indistinct, the terminal portion made up of two equal segments moderately elongated. Second antennae, mouth parts, and swimming legs like those of the female; fifth legs 3-segmented, the apical setae very long and slender. Total length, 0.75–0.9 mm.

Remarks.—This is the only "Cyclops" in the area whose fifth legs are 3-segmented, and it can be identified by this character alone. It seems to prefer shallow water full of vegetation rather than deeper and clearer locations.

Genus MESOCYCLOPS G. O. Sars, 1914

Body cyclopoid, metasome swollen and depressed, urosome slender; genital segment elongated and but little dilated anteriorly; caudal rami of moderate length and slightly divergent. First antennae 17-segmented; second antennae slender and 4-segmented, with elongate setae; rami of first four pairs of legs 3-segmented, end segment of exopod with two outer spines, two apical and two inner setae in the first legs, one apical and two outer spines, one apical and three inner setae in the other three pairs of legs; fifth legs very small and 2-segmented, basal segment with one, distal segment with two subequal setae. One species found here.

MESOCYCLOPS OBSOLETUS (Koch)

FIGURE 197

Cyclops obsoletus KOCH, Deutschlands Crustaceen, Myriapoden und Arachniden, pt. 21, pl. 5, 1838.

Mesocyclops obsoletus SARS, Crustacea of Norway, vol. 6, p. 58, pl. 35, 1914.

Occurrence.—Found in abundance in Bournes Pond, Falmouth; two of the small ponds on the road from Woods Hole to Falmouth; the Mill Pond at Woods Hole; the lily pond north of Nobska Light

House; Fresh Pond west of Nobska Light; Ice Pond at Quisset; Crockers Pond, Jones Pond, East Falmouth Pond, small lily pond south of Ashumet Pond, Bournes Pond, Browns Pond, Jenkins Pond, Mares Pond, all in the town of Falmouth; Flax Pond and Red Brook Pond in the town of Bourne; Santuit Pond, Mashpee Pond, John Pond, and Ashumet Pond in the town of Mashpee; Shallow Pond, Crescent Lake, Centerville, Long Pond, Newton, Lovells Pond, Chequaquet Lake (Great Pond), and Upper, Middle, and Lower Cotuit Ponds in the town of Barnstable; Flax Pond and Scargo Pond in the town of Dennis; Hinckleys Pond in the town of Harwich; Long Pond and Bangs Pond in the town of Brewster; two small ponds beside the main road west of Chatham; Tarpaulin Cove Pond, French Watering Place, Marys Lake, and West End Pond on Naushon Island; small pond west of Edgartown and Edgartown Great Pond on Marthas Vineyard; pond on Rams Head Island in Hadley Harbor.

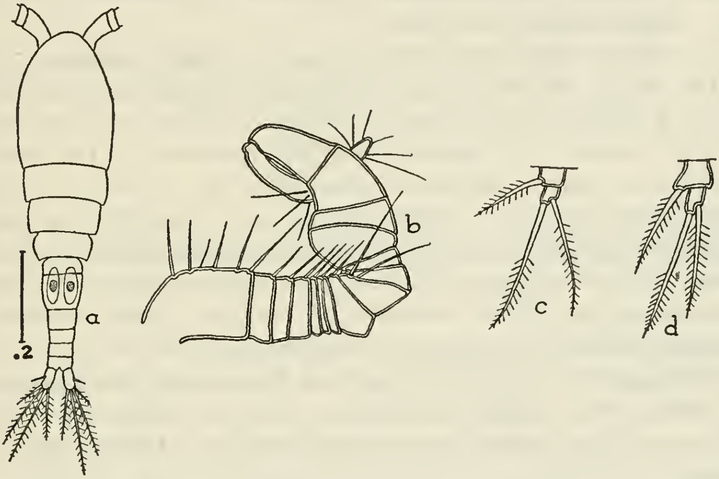

FIGURE 197.—*Mesocyclops obsoletus: a,* Male, dorsal; *b,* male, first antenna; *c,* male, fifth leg; *d,* female, fifth leg

Distribution.—Lake Albert Nyanza (Cunnington); Norwegian ponds and lakes (Sars); Europe (Claus, Schmeil, Richard, Lande); Asia (Uljanin); Russia (Poggenpol); North America (Herrick, Marsh, Forbes); Brazil (Sars); Hungary (Daday); Argentina (Sars); Netherlands (Hoeck); Rhode Island (Williams); Australia (Sars).

Color.—Body transparent with a grayish-white or bluish-green tinge; the cephalic segment often contains orange oil globules of various sizes, and the contents of the anterior and posterior portions of the digestive tract are orange-red. The eye is reddish, the eggs are pale yellow with a dark center.

Female.—Metasome regularly elliptical, the width slightly more than half the length; cephalic segment almost twice the length of the rest of the metasome; urosome slender, more than half the length of the metasome; genital segment as long as the abdomen and cylindrical; caudal rami shorter than the last two segments of the abdomen combined, outer seta near the center of the ramus, longest apical seta as long as the urosome. First antennae reaching the posterior margin of the third thoracic segment; end segment bordered by a hyaline membrane, sometimes serrate, sometimes with a single semilunar sinus, or with four or five such sinuses. Distal segment of fifth legs narrow, the two setae slender and elongate, the inner one somewhat removed from the tip. Anterior portion of the semen receptacle short and bilobed, extending across the segment, posterior portion tongue-shaped, prolonged lengthwise of the segment. Total length, 1–1.5 mm.

Male.—Much smaller than the female; cephalic segment longer than the rest of the metasome, its length to its width as 5:3; second, third, and fourth segments rather wide and slightly produced at the posterior corners; fifth segment abruptly narrowed to the width of the genital segment; abdomen 4-segmented, the segments diminishing but little in length or width; genital segment as long as the first two abdominal segments combined; caudal rami longer than the anal segment, but not so long as the last two segments together, with the lateral seta at the center of the outer margin. First antennae 17-segmented and twice hinged, the terminal portion made up of two elongated segments, the middle portion 4-segmented and enlarged at its proximal end. First four pairs of legs not modified; fifth legs like those of the female but somewhat smaller. Total length, 0.75–0.9 mm.

Remarks.—The list of ponds given above shows that this species is universally distributed through the fresh water of the area. It was not present in any of the brackish ponds but has been reported from brackish water in India. As Marsh has pointed out, it is easily recognized by the form of the caudal rami, since it is the only species with the first antennae 17-segmented in which the outer seta of the caudal rami is at the center. The elongate, subequal setae of the fifth legs are also characteristic.

Genus MACROCYCLOPS Claus, 1893

Metasome obovate, boldly arched dorsally; fifth thoracic segment no wider than the genital segment; urosome moderately stout; genital segment only slightly dilated anteriorly; caudal rami but little longer than the anal segment. First antennae 17-segmented, reaching the posterior margin of the third, or even the fourth thoracic segment. Rami of first four pairs of legs 3-segmented, end segment of first three exopods with three outer spines, of fourth exopod with only two spines; inner margin of this segment in first legs with three, in the following pairs with four, setae. Fifth legs 2-segmented, basal segment more or less elongate, with one seta; distal segment short, constricted at its base and 3-lobed at its tip, the middle lobe with a slender seta, each outer lobe with a spine, the two unequal.

KEY TO THE SPECIES

FEMALES

1. Third and fourth segments of second antenna the same length, twice that of the second segment; lamella on end segment of first antenna toothed------------------------------------ fuscus (p. 333)
   Second and third segments of second antenna the same length, fourth segment longer; lamella on end segment of first antenna smooth or lacking-- 2
2. Lamella of end segment of first antenna well defined, smooth and forming a lappet at the tip of the segment-------------- albidus (p. 335)
   Lamella of end segment of first antenna entirely lacking, or if present without a lappet at the tip of the segment----- bistriatus (p. 336)

MACROCYLOPS FUSCUS (Jurine)

FIGURE 198

Monoculus quadricornis fuscus JURINE, Hist. Monocles, p. 47, pl. 2, fig. 2, 1820.
Cyclops signatus KOCH, Deutschlands Crustaceen, Myriapoden und Arachniden, pt. 21, pl. 8, 1838.
Pachycyclops signatus SARS, Crustacea of Norway, vol. 6, p. 65, pl. 40, 1914.

Occurrence.—Both sexes found in a small pond near the outlet of John Pond in Mashpee, in Jones Pond at Waquoit Village, and in the pond on Rams Head Island in Hadley Harbor.

Distribution.—Germany (Koch); Sweden (Lilljeborg); British Isles (Brady); Poland (Landé); France (Richard); Norwegian lakes and ponds, central Asia (Sars); Minnesota (Herrick); Wisconsin, Michigan (Marsh); Illinois, Massachusetts (E. B. Forbes); Nebraska (Pearse); Arkansas, Louisiana (Marsh).

Color.—Body more or less transparent and of a dark greenish or bluish color, variegated with brown; anterior antennae, legs, caudal rami, and the last two abdominal segments bluish green; eggs dark brown; eye reddish.

Female.—Metasome ovate, twice as long as wide; cephalic segment considerably more than twice as long as the rest of the metasome; fifth segment very small; urosome about one-third the length of the metasome; genital segment as long as entire abdomen; caudal rami a little longer than the anal segment, their inner margins finely ciliated, the outer seta close to the tip. First antennae reaching the end of the third segment; hyaline membrane on its end segment coarsely dentate for the proximal half, finely denticulate or smooth for the distal half. Third and fourth segments of second antenna equal and twice as long as the second segment, which is coarsely denticulate on its posterior margin. Outer apical spine of fourth endopod much larger than the inner one and armed on its inner margin with several large spinules in place of the usual teeth. Basal segment of fifth legs quadrangular, fringed with spines on its inner margin; distal segment shorter and narrower, its inner spine twice the length of the outer. Posterior part of semen receptacle usually bright red and tongue-shaped, with a narrow posterior median cleft reaching beyond the center. Ovisacs pressed tightly against the sides of the urosome. Total length, 2–4 mm.

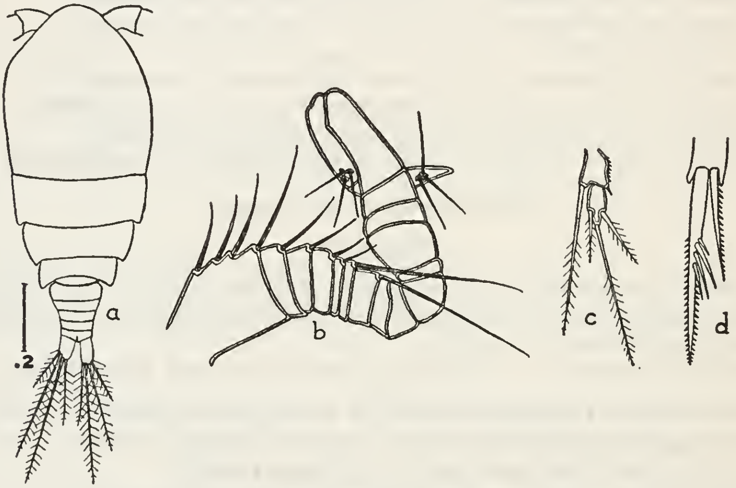

FIGURE 198.—*Macrocyclops fuscus: a,* Male, dorsal; *b,* male, first antenna; *c,* male, fifth leg; *d,* female, apical spines of the fourth endopod

Male.—Body short and stout; cephalic segment narrowed anteriorly and almost squarely truncated posteriorly, and nearly twice as long as the rest of the metasome, its length to its width as 6:5; second, third, and fourth segments wide and slightly produced at their posterior corners into small blunt knobs; fifth segment abruptly reduced to half the width of the fourth, and partly concealed by the latter; genital segment twice as wide as long and wider than the fifth segment; abdomen 4-segmented, each segment two or three times as wide as long; caudal rami as long as the last two abdomen segments combined, the outer seta close to the tip. First antennae 17-segmented and twice hinged, the middle section elongate and 5-segmented, its proximal segments only slightly swollen. Total length, 1–1.25 mm.

Remarks.—This is one of the largest of our American species and may be distinguished first by its size, then by its dark color, and by the close appression of the ovisacs to the sides of the urosome, so as to conceal much of the surface of the latter in dorsal view. It is apparently a true bottom form and is very agile, darting about among the débris on the bottom so rapidly that it often escapes capture.

MACROCYCLOPS ALBIDUS (Jurine)

FIGURE 199

Monoculus quadricornis albidus JURINE, Hist. Monocles, pp. 44, 47, pl. 2, figs. 10. 11, 1820.

Cyclops annulicornis KOCH, Deutschlands Crustaceen, Myriapoden und Arachniden, pt. 21, pl. 6, 1838.

Pachycyclops annulicornis SARS, Crustacea of Norway, vol. 6, p. 68, pl. 42, 1914.

Occurrence.—Found in moderate abundance in Mill Pond at Woods Hole, in Salt Pond and Oyster Pond, Falmouth, in Sidleys Pond, Falmouth Village, and Little Pond, Falmouth Heights, in small pond near the outlet of John Pond, Mashpee, in two small ponds on the main road west of Chatham, and in the pond on Rams Head Island in Hadley Harbor.

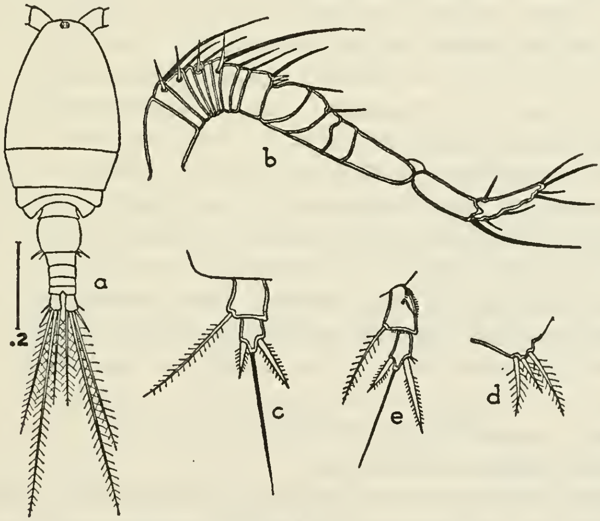

FIGURE 199.—*Macrocyclops albidus: a,* Male, dorsal; *b,* male, first antenna; *c,* male, fifth leg; *d,* male, sixth leg; *e,* female, fifth leg

Distribution.—Germany (Koch, Schmeil); Europe, northern Asia, central Africa, Australia, Hawaiian Islands, Norwegian lakes (Sars); Turkestan (Uljanin); Poland (Landé); British Isles (Baird, Brady); Switzerland (Heller); Russia (Poggenpol); Netherlands (Hoeck); North America (Herrick, Marsh, E. B. Forbes); Massachusetts (Cragin).

Color.—Body a clear yellowish gray, more or less tinged with blue or green, with dark brown transverse bands across the cephalon and thoracic segments; anterior antennae each with two dark bands, one including the second and third, the other the tenth and eleventh segments; eggs dark brown; eye very small and bright red, sometimes rather light in shade.

Female.—Metasome broadly oval, breadth considerably more than half the length; urosome slender, two-fifths as long as metasome; caudal rami short, the outer seta close to the tip; genital segment not as long as the abdomen. Hyaline membrane on end segment of first antenna perfectly smooth and projecting as a lappet at the end of the segment; second and third segments of second antenna equal in length, fourth segment a half longer. Basal segment of fifth leg fringed on its inner margin with minute cilia; a row of the same cilia and a small seta on the surface of the segment near its base; distal segment shorter and narrower, the two spines stout and denticulate, the seta filiform. Ovisacs standing out nearly at right angles to the body axis; posterior part of semen receptacle very short and slightly emarginate at the center, but without a cleft. Total length, 1–1.8 mm.

Male.—Larger than the female; cephalic segment about twice the length of the rest of the metasome; fourth segment much wider than the fifth and turned backward on each side of the latter; genital segment with convex sides; caudal rami rather squarely truncated, the longest apical setae three-fourths of the body length. First antennae geniculate, the terminal portion made up of two elongate segments, the end segment tapering to a pointed tip; the middle portion, segments 11 to 15, inclusive, is more or less fused and moved as one piece by a single broad and powerful muscle. Both segments of the fifth leg are shorter and wider than in the female, but are similarly armed. There is also a pair of rudimentary sixth legs at the posterior corners of the genital segment, each consisting of a small lamina with three setae. Total length, 1.5–2.5 mm.

Remarks.—This species may be distinguished by the smooth hyaline membrane on the end segment of the first antenna and the lappet it forms at the tip of the segment. According to Sars, this copepod is found both in large lakes and small ponds and ditches, and often descends to considerable depths.

MACROCYCLOPS BISTRIATUS (Koch)

FIGURE 200

Cyclops bistriatus KOCH, Deutschlands Crustaceen, Myriapoden und Arachniden, pt. 21, pl. 7, 1838.

Pachycyclops bistriatus SARS, Crustacea of Norway, vol. 6, p. 67, pl. 41, 1914.

Occurrence.—A few specimens were obtained in a small pond near the outlet of John Pond, Mashpee, in the Ice Pond at Quisset, and in Crockers Pond in Falmouth.

Distribution.—Germany (Koch, Schmeil); Sweden (Lilljeborg); France (Richard); Poland (Landé); Norway (Sars); North America (Herrick).

Color.—Body dark blue, somewhat tinged with brown; the anterior portion of the cephalic segment and sometimes the whole segment is lighter than the rest of the body; eggs brown; eye reddish.

Female.—Metasome broadly oval, breadth somewhat more than half the length; urosome slender, one-third as long as the metasome; genital segment as long as the three abdominal segments combined. No hyaline membrane visible on the first antennae; second and third segments of second antennae equal in length, fourth segment one-fourth longer. Basal segment of fifth leg ciliate on its inner margin, distal segment as wide and as long as the basal segment, with a minute spine on each lateral margin closely proximal to the regular lateral spine. Ovisacs only slightly divergent; semen receptacle elongate, its posterior portion tongue-shaped, with a median posterior fissure extending beyond the center. Total length, 1.5–2.25 mm.

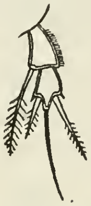

FIGURE 200.—*Macrocyclops bistriatus:* Female, fifth leg

Male.—Unknown.

Remarks.—Marsh made this species a synonym of what he designated as *Cyclops albidus* Jurine, but Schmeil and Sars have regarded it as a distinct species, and it seems as well founded as any of the others. It may be distinguished by the fact that the second and third segments of the second antennae are equal and the fourth segment is longer than either of them, the end segment of the first antennae has no hyaline membrane, and the fifth leg has minute secondary spines.

Genus EUCYCLOPS Claus, 1893

Body slender, the two divisions sharply defined; metasome obovate, the epimeral plates well defined and prominent; fifth segment produced on either side into a hairy lobe, overlapping the base of the genital segment; urosome slender; genital segment swollen anteriorly, narrowed posteriorly; caudal rami elongate and finely or coarsely denticulate or smooth on their outer margins. First antennae 12-segmented; second, third, and fourth segments of second antennae equal in length. Rami of first four pairs of legs 3-segmented; fifth legs very small, 1-segmented; trilobed at their tips, the inner lobe armed with a denticulate spine; each of the other two lobes with a filiform seta.

KEY TO THE SPECIES (FEMALES)

1. Outer margin of caudal rami coarsely toothed, the teeth increasing in length distally; outer seta close to tip-------------- agilis (p. 338)
Outer margin of caudal rami smooth, without teeth; outer seta near center of outer margin---------------------------- prasinus (p. 339)

EUCYCLOPS AGILIS (Koch)

Figure 201

Cyclops agilis Koch, Deutschlands Crustaceen, Myriapoden und Arachniden, pt. 21, pl. 3, 1838.

Leptocyclops agilis Sars, Crustacea of Norway, vol. 6, p. 71, pl. 43, 1914.

Occurrence.—Found in greater or less abundance in all the fresh-water ponds in and around Woods Hole and along Cape Cod to Chatham, in Edgartown Great Pond and two small ponds on Marthas Vineyard, and in most of the fresh-water ponds on the Elizabeth Islands.

Color.—Body dark olive-green, banded across the thorax, the genital segment and the bases of the caudal rami with reddish brown. Eye bright red. Eggs light bluish white.

Distribution.—Europe; central and northern Asia; Algeria; Azores; polar islands north of Grinnell Land; North America; Australia; New Zealand (Brady); Nantucket Island (Pearse); Rhode Island (Williams).

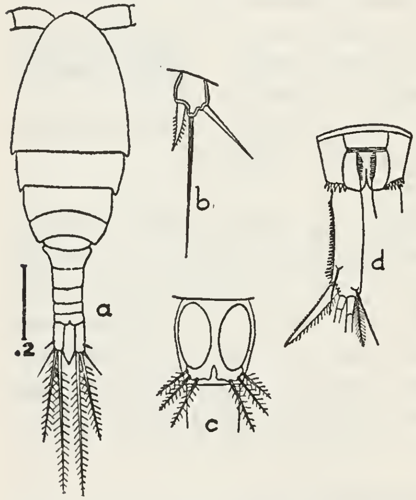

Figure 201.—*Eucyclops agilis: a*, Male, dorsal; *b, c*, male, fifth and sixth legs; *d*, anal segment and caudal ramus

Female.—Metasome elliptical, width slightly more than half the length; urosome less than half the length of the metasome; genital segment as long as the first two abdominal segments combined; caudal rami twice the length of the anal segment, curved slightly outward, their outer margins denticulate, the teeth increasing in size distally, the outer seta close to the tip of the ramus.

First antennae reaching the distal end of the second metasome segment, the last three segments with a smooth lateral membrane. Outer spines on first four exopods 3, 4, 4, 3; inner spine of fifth leg as long as outer one and coarsely dentate. Anterior portion of semen receptacle transversely elliptical and slightly emarginate at the center; posterior portion also emarginate at the center and tapered on either side to a bluntly rounded point. Total length, 1–2 mm.

Male.—Body smaller and more slender than in the female; cephalic segment one-fourth longer than the rest of the metasome, second, third, and fourth segments diminishing regularly in width, the second only with projecting corners; urosome shorter and stouter than in the female; genital segment considerably dilated at its anterior margin; caudal rami shorter and without the serrate spines on their outer margins. First antennae twice geniculate, reaching the fourth metasome segment when straightened and reflexed, the middle section scarcely swollen at all, the terminal section quite short; rudimentary sixth legs at posterior corners of genital segment, each with three plumose setae. Total length, 0.75–0.9 mm.

Remarks.—This is a very cosmopolitan species and is found at the margin of the largest lakes as well as in ditches and small pools. It is a true bottom form and moves about with restless energy and considerable speed. It is almost never captured in surface tows or in company with those species that are designated as limnetic. It is also strictly a fresh-water copepod and is averse to even the slightest degrees of salinity.

EUCYCLOPS PRASINUS (Fischer)

FIGURE 202

Cyclops prasinus FISCHER, Abh. math.-phys. Classe kön. Akad. Wiss., Munich, vol. 8, p. 652, pl. 20, figs. 19–26a, 1860.—MARSH, Trans. Wisconsin Acad. Sci., vol. 16, pt. 2, no. 3, p. 1097, pl. 79, figs. 1, 2, 3, 10, 1910.

Occurrence.—A limited number of both sexes was obtained from a small pond near the outlet of John Pond, Mashpee, from Great Pond, Barnstable, and from a small pond near Edgartown on Marthas Vineyard.

Color.—Body transparent, with a brownish tinge, especially upon the dorsal surface; a narrow band of reddish brown across the posterior margin of the cephalothorax; second metasome segment much lighter than the following segments; no eye visible; urosome bluish; younger specimens nearly white. Herrick said that the color varied from deep indigo blue to greenish brown, and Forbes found both blue and pink specimens, so that the color is not at all constant. The prevailing color of European specimens is green.

Distribution.—Azores (Richard); Ceylon (Daday); Calcutta (Gurney); Germany (Vosseler); France (Richard); British Isles (Brady, Scourfield); Switzerland (Graeter); Great Lakes (Marsh); Minnesota (Herrick); Massachusetts (Cragin, Forbes); Wisconsin (Marsh); Nebraska (Brewer); Indiana (Juday); Mississippi Valley, Florida (Forbes).

Female.—Metasome elliptical, about twice as long as wide; cephalic segment three-fifths of the metasome length, squarely truncated anteriorly; fifth segment fringed with cilia on its lateral margins. Urosome less than half the length of the metasome; genital segment only slightly dilated anteriorly; caudal rami short and slightly divergent, outer margin without spines, outer seta near the center. First antennae reaching the end of the third metasome segment, the last three segments with a narrow lateral membrane. Outer exopod spines on last segment of the first four legs 3, 3, 3, 2; fifth leg trilobate, inner spine little shorter than outer and sparsely dentate, middle seta elongate and borne on the tip of a conical process. Anterior portion of semen receptacle made up of two transversely **S**-shaped canals, fused at the center into a longitudinal stalk; posterior portion composed of a rounded sack on each lateral margin of the segment, connected by a transverse stalk, which joins the longitudinal one from the anterior portion. Total length, 0.4–0.7 mm.

Male.—Smaller than the female, the cephalic segment relatively shorter and rounded anteriorly; urosome more than half the length of the metasome, 5-segmented; genital segment as wide as the fifth segment anteriorly, but narrowed posteriorly and no longer than the basal abdominal segment; the four abdominal segments about the same length and width; caudal rami no longer than anal segment, divergent. First antennae twice geniculate, the middle section scarcely enlarged; second antennae, mouth parts, and first four pairs of legs as in the female; fifth leg 3-lobed, the inner spine longer and stouter than in the female. Total length, 0.35–0.6 mm.

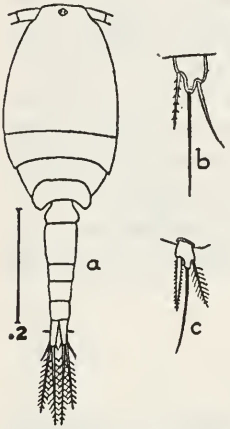

FIGURE 202.—*Eucyclops prasinus: a,* Female, dorsal (after Sars); *b,* female, fifth leg; *c,* male, fifth leg

Remarks.—Marsh said of this species: "Its characteristic habitat is lakes rather than pools," but Pearse added: "It occurs in all situations from great lakes and rivers to temporary puddles of but a few weeks' duration."[12] It is nowhere abundant.

Genus ECTOCYCLOPS Brady, 1904

Body short and stout; metasome elliptical, one-half longer than wide, with epimeral plates on the second, third, and fourth segments; urosome stout, about half as long as metasome, 4-segmented in female, 5-segmented in male; caudal rami short and stout, inner caudal seta twice as long as outer. First antennae 10-segmented, first and

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[12] Bull. Illinois Lab. Nat. Hist., vol. 5, p. 58, 1897.

sixth segments longest; second antennae 4-segmented, without an exopod. Rami of first four pairs of legs 3-segmented; fifth leg entirely fused with the fifth metasome segment, represented by a plate armed with three stout plumose setae. A single species.

ECTOCYCLOPS PHALERATUS (Koch)

Figure 203

Cyclops phaleratus Koch, Deutschlands Crustaceen, Myriapoden und Arachniden, p. 21, pl. 9, 1838.

Ectocyclops rubescens Brady, Proc. Zool. Soc. London, vol. 2, p. 124, pls. 6, 7, 1904.

Platycyclops phaleratus Sars, Crustacea of Norway, vol. 6, p. 78, pl. 48, 1914.

Occurrence.—Both sexes were obtained in the fresh-water pond on Rams Head Island in Hadley Harbor.

Distribution.—Europe, Australia (Sars); Germany (Koch, van Douwe, Schmeil); Turkestan (Ganin, Uljanin); Norway (Sars); British Isles (Brady, Lubbock, T. Scott); Hungary (Daday); Russia (Poggenpol, Fischer); Sweden (Lilljeborg); Bohemia (Frić); Croatia (Sostaric); Poland (Landé); Surinam (Chappius); Ohio (Turner); Illinois, Wisconsin, Michigan, Alabama, Manitoba (Forbes); Massachusetts (Cragin).

Color.—Entire body dark reddish brown, the first free metasome segment lighter with a bluish tinge and almost transparent. The head is also lighter than the rest of the body except at the posterior margin, where the reddish brown forms a dark transverse band. The anal segment, the swimming legs, and the caudal rami are bluish like the second segment; eggs dark blue, almost black; eye reddish, with a yellow spot surrounding it.

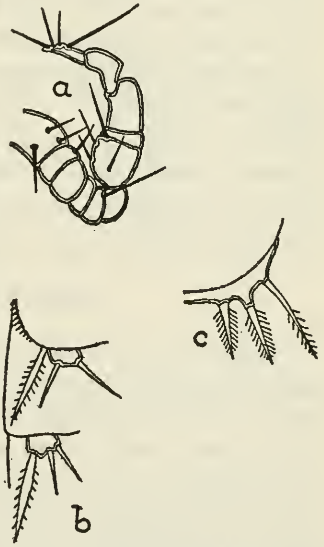

Figure 203.—*Ectocyclops phaleratus: a,* Male, first antenna; *b,* male, fifth and sixth legs; *c,* female, fifth leg

Female.—Metasome elliptical, two-thirds as wide as long; cephalic segment as long as the four following segments; urosome half as long as metasome, its segments coarsely denticulated along their posterior margins ventrally and laterally; genital segment not so long as first two abdominal segments combined; caudal rami less than twice as long as wide, each with three oblique rows of spinules on its dorsal surface and one on the ventral surface. First antennae 10-segmented in most European specimens, but often 11-segmented in America;

second antennae 4-segmented, without an exopod, the fourth segment much shorter than the third. Outer exopod spines on first four legs 3, 4, 4, 3; each fifth leg fused with the body segment and represented by a plate armed with three setae, the outer one less densely plumose than the other two. Semen receptacle occupying nearly the whole width of the genital segment, anterior portion transversely elliptical, posterior portion made up of two parts, each semilunar and pointed distally. Total length, 0.9–1.26 mm.

Male.—Body more slender than in the female; cephalic segment relatively shorter; epimeral plates on second, third, and fourth segments pointed; urosome 5-segmented, the segments diminishing in width posteriorly; caudal rami nearly as wide as long, the apical setae jointed near their base, the inner one longer than the urosome. First antennae 10- or 11-segmented, twice geniculate, the terminal section made up of two segments; fifth leg like that of the female but not so completely fused with the body segment; a sixth leg, similar to the fifth, at each posterior corner of the genital segment. Total length, 0.75–0.93 mm.

Remarks.—This species is world-wide in its distribution but not abundant anywhere. Forbes said:

> The best character for the ready recognition of this species is its strong superficial resemblance to the genus *Canthocamptus.*

This, combined with the rudimentary form of the fifth legs, makes it comparatively easy to identify.

Genus PARACYCLOPS Claus, 1863

Body stout; metasome flattened, with lateral epimeral plates; fifth segment short, its lateral margins fringed with hair; urosome stout, subcylindrical; genital segment a little wider than long; caudal rami many times longer than wide, with dorsal spinules. First antennae 8-segmented and very short; fourth segment of second antenna much shorter than third. Outer exopod spines of first four pairs of legs 3, 4, 4, 3; each fifth leg a 3-lobed lamella, with one apical and one outer seta, and a long inner denticulated spine. A single species.

PARACYCLOPS FIMBRIATUS (Fischer)

FIGURE 204

Cyclops fimbriatus FISCHER, Bull. Soc. Imp. Nat. Moscow, vol. 26, pt. 1, p. 94, pl. 3, figs. 19–28, 1853.

Platycyclops fimbriatus SARS, Crustacea of Norway, vol. 6, p. 81, pl. 50, 1915.

Paracyclops fimbriatus KIEFER, Das Tierreich, Lief. 53, p. 41, 1929.

Occurrence.—Both sexes found in Gosnold Upper Pond on Cuttyhunk Island and in the small pond on Rams Head Island in Hadley Harbor.

Distribution.—Russia (Fischer); Sweden (Lilljeborg); Germany (Vosseler, Schmeil); Poland (Landé); Norway (Sars); France (Richard); Bohemia (Frič); Turkestan (Uljanin); British Isles (Brady, Scott); Hungary (Daday); United States (Forbes); Minnesota (Herrick); Ohio (Turner); Nantucket Island (Forbes).

Color.—Body rather opaque and light brown, with red oil globules scattered through the metasome; eye bright red; eggs violet or purple.

Female.—Metasome elliptical, a little more than half as wide as long; cephalic segment considerably longer than the rest of the metasome; urosome two-fifths as long as metasome; genital segment nearly as long as entire abdomen; caudal rami six times as long as wide, each with a curved row of dorsal spinules. First antennae 8-segmented, densely setose; fourth segment of second antenna only half as long as third. Anterior portion of semen receptacle enlarged, sometimes reaching the anterior margin of the segment, and transversely elliptical; posterior portions not divided at center and tapered to a sharp point on either side. Ovisacs oblong oval and closely appressed to the sides of the abdomen; eggs large. Total length, 0.9–1.1 mm.

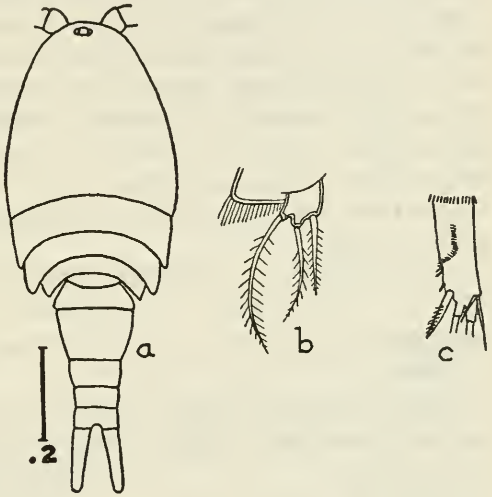

FIGURE 204.—*Paracyclops fimbriatus: a,* Female. dorsal (after Sars); *b,* female, fifth leg; *c,* caudal ramus

Male.—Smaller than the female, the cephalic segment relatively shorter; urosome 5-segmented and considerably more than half the length of the metasome; caudal rami the same length and with the same armature as in the female. First antennae 8-segmented, once geniculate, the setae on the first and sixth segments peculiarly modified; fourth segment of second antenna relatively longer than in the female; the five pairs of legs the same, but there is also a rudimentary sixth pair at the posterior corners of the genital segment. Total length, 0.75–0.85 mm.

Remarks.—This is the only "cyclops" species of the present area whose first antennae are 8-segmented, and in matured females with egg strings may be recognized by this character. It is a bottom form and keeps close to the ground amid the débris. Richard characterized it as a very poor swimmer, but said that it could move rapidly over a moist surface by means of the dense setae on the first antennae.

He also found it would live and reproduce as well in mineral water as in fresh water.

Family CLAUSIDIIDAE

Genus CLAUSIDIUM Kossmann, 1875

Female.—Body short, broad, and strongly flattened; head fused with first segment, second and third segments free; fourth and fifth segments fused and covered with a single plate; no eye visible. Urosome 3- or 4-segmented; genital segment widened but little; caudal rami longer than wide, each tipped with two setae. First antennae 7-segmented; second antennae 3-segmented, nonprehensile, tipped with long setae. First four pairs of legs biramose, rami 3-segmented; fifth legs uniramose, 1-segmented.

Male.—Body elongate, slender, flattened; head fused with first segment, the other segments free; fourth and fifth segments separated, but the dorsal plate of the fourth segment overlaps the base of the fifth segment. Urosome 5-segmented; genital segment divided, with a pair of spines at the posterior corners; caudal rami longer than wide, each armed with four setae. Appendages like those of the female except the maxillipeds, which are subchelate. A single species.

CLAUSIDIUM DISSIMILE Wilson

FIGURE 205

Clausidium dissimile WILSON, Proc. U. S. Nat. Mus. vol. 59, p. 427, pls. 94, 95, 1921.

Occurrence.—Two males and two females from branchial chamber of *Callianassa stimpsoni* Smith, captured in Vineyard Sound, September 2, 1901; 25 specimens, including both sexes, from branchial chamber of *Callianassa* species (probably *stimpsoni*) at Cold Spring Harbor, Long Island, N. Y.

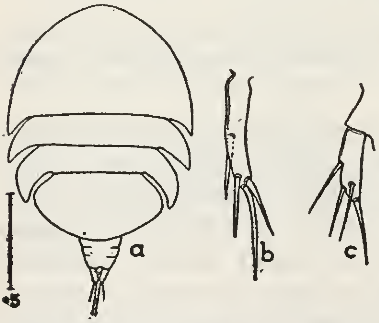

FIGURE 205.—*Clausidium dissimile*: *a*, Female, dorsal; *b*, female, fifth leg; *c*, male, fifth leg

Distribution.—Found only in the two localities just mentioned, but it is likely to occur wherever *Callianassa* crabs can be secured.

Color.—Body a bright red, deepest along the margins of the segments.

Female.—Cephalic segment twice as wide as long, its posterior corners produced backward; second and third segments as wide as the head, with lateral epimeral plates; dorsal plate of fused fourth and fifth segments covering the basal segments of the fourth and fifth legs and part of the genital segment; caudal rami one-half longer than wide, in contact at their tips. Second segment of first antennae the longest, fourth segment the shortest; end segment of second antenna with four apical setae. The spine on the inner margin of the first endopod's basal segment is short and blunt, and turned distally inside the other two segments; the spine on the second segment is foot-shaped, and that on the third segment is claw-shaped. The fifth leg is three times as long as wide, with four spines, one of which is apical. Total length, 1.25–1.5 mm.

Male.—Cephalic segment scarcely wider than long, the remaining segments free and diminishing regularly in width, the second and third with epimeral plates pointed backward. Genital segment quadrangular, completely divided across the center, with a fingerlike process tipped with a single spine on each lateral margin of the anterior part, and a spine at each corner of the posterior part; the last two abdominal segments are almost completely divided longitudinally at the center; each caudal ramus carries three apical setae and one on the outer margin. Total length, 0.6–0.7 mm.

Remarks.—Only a few crabs have been examined for these copepods, and it is probable that further search will show the parasite to be fairly abundant.

Genus HEMICYCLOPS Boeck, 1873

Body cyclopoid, metasome dilated and more or less flattened; head fused with first segment, much wider than long; second, third, and fourth segments but little narrowed, fifth segment abruptly reduced to half the width of the fourth. Urosome slender, 4- or 5-segmented (genital segment divided); caudal rami short and stout. First antennae 7-segmented; second antennae 4-segmented, with long curved apical setae; maxillipeds 3-segmented and scarcely prehensile in female, powerfully developed and prehensile in male. Rami of first four pairs of legs 3-segmented; fifth legs 2-segmented, uniramose; distal segment a broad lamella with marginal setae, the terminal one filiform, the others plumose. A single species.

HEMICYCLOPS ADHERENS (Williams)

FIGURE 206

Lichomolgus adherens WILLIAMS, 37th Ann. Rep. Comm. Inland Fisheries Rhode Island, p. 75, pl. 2, 9 figs, 1907.

Occurrence.—Found abundantly under small stones between tides at the mouth of Narragansett Bay, R. I., by Williams.

Distribution.—Not found as yet in any other locality.

Color.—Not recorded.

Female.—Metasome elliptical, three-fourths as wide as long, without epimeral plates; urosome half as long as metasome, 5-segmented, the genital segment being divided at the center; anterior portion of genital segment a little dilated; anal segment with a posterior fringe of spines; caudal rami twice as long as wide and slightly divergent, First antennae shorter than the cephalic segment; second antennae tipped with seven elongate, curved unequal setae; middle segment of maxillipeds not produced on the inner margin and without setae. Endopods of swimming legs longer than exopods; distal segment of fifth legs elliptical, more than twice as long as wide, with four marginal setae, the second inner one filiform. Total length, 1.2–1.3 mm.

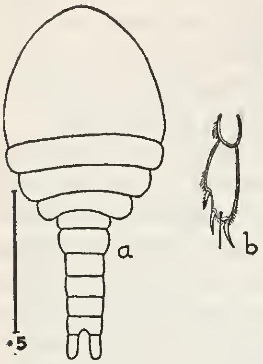

FIGURE 206.—*Hemicyclops adherens: a,* Female, dorsal (after Williams); *b,* female, fifth leg

Male.—Unknown.

Remarks.—Williams placed this species in the genus *Lichomolgus*, but several characters render such an assignment impossible. The structure of the second antennae, the mouth parts, the endopod of the fourth legs, and the fifth legs are all very different from those of the genus *Lichomolgus* and agree quite closely with those of the genus *Hemicyclops*, the differences being such as would be expected in a new species of that genus. Accordingly the species is here transferred to *Hemicyclops.*

Family LICHOMOLGIDAE

Genus MYICOLA Wright, 1885

Metasome of female cylindrical, of male flattened and elliptical; fifth segment rather abruptly narrowed; urosome 4-segmented in female, 5-segmented in male; genital segment short with convex sides; caudal rami long and narrow. First antennae 6- or 7-segmented; second antennae 3-segmented, prehensile; maxillipeds lacking in the female, present and well developed in the male. Rami of first four pairs of legs 3-segmented; fifth legs uniramose, 2- or 3-segmented.

KEY TO THE SPECIES (BOTH SEXES)

1. Second antenna with a single apical claw; fifth leg 3-segmented -- mitisiensis (p. 346)
   Second antenna with 2 claws and 3 setae; fifth leg 2-segmented -- major (p. 347)

MYICOLA METISIENSIS R. R. Wright

FIGURE 207

Myicola metisiensis WRIGHT, Amer. Nat., vol. 19, p. 118, pl. 3, figs. 1–10, 1885.

Occurrence.—Found in the mantle cavity of the long-necked clam (*Mya arenaria*), at Wellfleet, Mass., 1925.

Distribution.—In mantle cavity of same host at Little Metis, Quebec (Wright).

Color.—Body grayish white; contents of digestive canal bluish green.

Female.—Head separated from first segment, wider than long; first four thoracic segments diminishing slightly in width, but about the same length; fifth segment abruptly contracted to half the width and one-fourth the length of the fourth segment. Urosome one-fourth the length of the metasome; caudal rami as long as the last two abdominal segments combined. First antennae 7-segmented; second antenna tipped with a single stout claw; fifth leg 3-segmented, first and second segments with an outer distal seta, end segment with one apical, two outer setae, and a subapical group of spines. Total length, 2.75–3 mm.

Male.—Metasome spindle-shaped, tapering anteriorly and posteriorly; fifth segment but little narrower and fully as long as fourth; urosome half the length of the metasome; genital segment considerably enlarged; posterior margins of the genital and first two abdominal segments denticulate. Maxillipeds 2-segmented, with a long and powerful terminal claw; other appendages like those of the female. Total length, 1.5–1.75 mm.

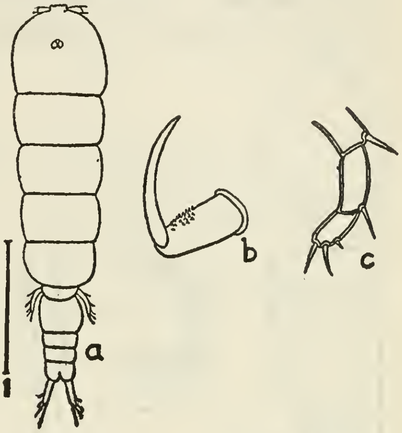

FIGURE 207.—*Myicola metisiensis: a,* Female, dorsal (after Wright); *b,* male, maxilliped; *c,* female, fifth leg

Remarks.—The female of this parasite sometimes lodges in the gill tubes of the clam and may then be detected by local swellings of the tube corresponding to the length of the copepod parasite.

MYICOLA MAJOR (Williams)

FIGURE 208

Lichomolgus major WILLIAMS, 37th Ann. Rep. Comm. Inland Fisheries Rhode Island, p. 77, pl. 3, 7 figs., 1907.

Occurrence.—Both sexes were obtained by Williams from the mantle cavity of the common clam (*Mya arenaria*), the quahog clam (*Venus mercenaria*), and the sea clam (*Mactra solidissima*), in Narragansett Bay.

Distribution.—It has not as yet been found in any other locality.

Color.—Body fairly transparent, of a uniform grayish or pinkish.

Female.—Metasome cylindrical; head fused with first segment and about as long as wide; second, third, and fourth segments tapered but little; fifth segment abruptly reduced to half the width of the fourth segment, but about the same length. Urosome half as long as metasome, tapered posteriorly; caudal rami a little longer than the anal segment, six times as long as wide. First antennae 6-segmented, second segment the longest; end segment of second antenna tipped with two stout curved claws and three long nearly straight setae. The distal margin of the second basipod and the outer margins of both rami of the first leg are fringed with stout triangular spines. The fifth leg is 2-segmented, the distal segment three times as long as wide, with a long apical, and two stout outer, serrate spines, and a stalked filiform seta on the dorsal surface near the tip. Total length, 1.1–1.3 mm.

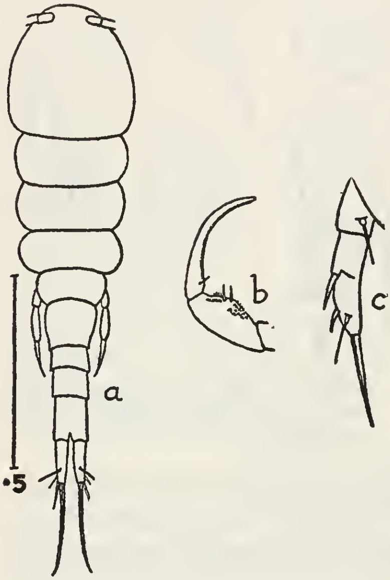

Figure 208.—*Myicola major: a,* Female, dorsal (after Williams); *b,* male, maxilliped; *c,* female, fifth leg

Male.—Much larger than the female, but of the same general shape; genital segment swollen and bearing on each lateral margin a fringe of spines and a single seta. Antennae, mouth parts, and swimming legs as in the female, except that a pair of 2-segmented maxillipeds is present, whose second segment is swollen and armed with two rows of tubercles and two setae on its inner surface; the apical claw is sickle-shaped, enlarged at its base, and serrate on its inner margin. Total length, 1.75–1.9 mm.

Remarks.—This is another species referred by Williams to the genus *Lichomolgus*, but which evidently belongs in the genus *Myicola*, as shown by the general shape of the body, the parasitism upon bivalve mollusks, the absence of maxillipeds in the female and the presence of a stout pair in the male, the peculiar spines on the margins of the first legs, and the general structure of the fifth legs. This species will probably be found in other localities in the southern part of the present area, while the preceding species is the more northern form of the same genus.

Genus MACROCHEIRON Brady, 1872

Metasome elliptical, a little more than half as wide as long; head fused with first segment, one-half longer than rest of metasome; urosome 4-segmented in female, 5-segmented in male; genital segment swollen anteriorly, sometimes divided; caudal rami longer than the anal segment. First antennae 7-segmented; second antennae 3- or 4-segmented; rami of first four pairs of legs 3-segmented, except the fourth endopod, which is 2-segmented; fifth leg 1-segmented, elongate, curved, with two apical setae. A single species.

MACROCHEIRON FUCICOLUM Brady

FIGURE 209

Macrocheiron fucicolum BRADY, Nat. Hist. Trans. Northumberland and Durham, vol. 4, pt. 2, p. 434, pl. 18, figs. 9–18, 1872.—SARS, Crustacea of Norway, vol 6, p. 163, pl. 91, 1917.

Occurrence.—A few specimens of both sexes were found in the tow among eelgrass and algae at Katama Bay, Marthas Vineyard.

Distribution.—Narragansett Bay and Charlestown Pond (Williams); Buzzards Bay (Sharpe); British Isles (Brady, Scott); Norwegian coast (Sars); Liverpool Bay (Thompson).

Color.—Female semitransparent with a pale yellowish-brown tinge; posterior margins of the head and thoracic segments light rose-red; ovary, oviducts, and eggs olive-green; eye dark red and close to anterior margin.

Female.—Metasome regularly elliptical and strongly arched dorsally; cephalic segment about twice as long as the rest of the metasome; no epimeral plates. Urosome half the length of metasome; genital segment about as long as abdomen, dilated anteriorly. Second segment of first antenna the longest; second antenna 3-segmented; two basal segments massive, end segment with strong apical claw, irregularly toothed on concave margin; fifth leg with two unequal apical setae. Total length, 1–1.25 mm.

Male.—Smaller than female, metasome relatively narrower; genital segment much inflated. Maxillipeds very strong, 3-segmented, basal segment with smooth margins; second segment with a dense fringe of slender setae on the inner margin and two spines near the center; third segment a smooth sickle-shaped claw bent abruptly near the base. Other appendages like those of the female. Total length, 0.8–0.95 mm.

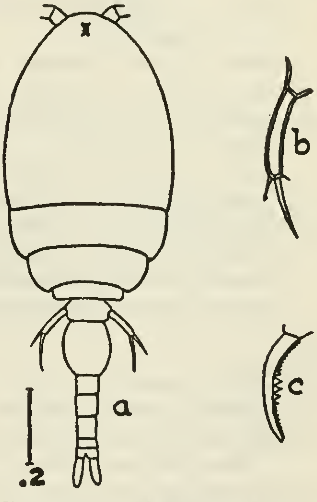

FIGURE 209.—*Macrocheiron fucicolum: a,* Female, dorsal (after Sars); *b,* female, fifth leg; *c,* apical claw of second antenna

Remarks.—This is a littoral form found at moderate depths among algae. It has been suggested that its food consists of the juices of the algae and small particles picked up on the surface of the fronds.

Apparently this species never becomes parasitic, but always remains free swimming.

Family ONCAEIDAE

Genus ONCAEA Philippi, 1843

Body cyclopoid; metasome elongate, elliptical, strongly vaulted dorsally; head separated from first segment and about half the length of the metasome. Urosome 4-segmented in female, 5-segmented in male; genital segment considerably enlarged, especially in male; caudal rami shorter than anal segment. First antennae 6-segmented; second antennae 3-segmented, nonprehensile; rami of first four pairs of legs 3-segmented, end segments elongated, exopods with coarse daggerlike spines; fifth legs minute, each 1-segmented, with two subequal apical setae.

KEY TO THE SPECIES

FEMALES

1. Second thoracic segment raised into a prominent hump on dorsal midline ---------- 2
   Second thoracic segment smooth dorsally, no hump ---------- 3
2. Genital segment from one-half longer to twice as long as abdomen; inner apical seta of fifth leg twice as long as outer one ---------- **conifera** (p. 350)
   Genital segment scarcely longer than abdomen; the 2 apical setae of fifth leg subequal in length ---------- **borealis** (p. 351)
3. Cephalic segment as long as rest of metasome, widest at its posterior margin; metasome elliptical ---------- **minuta** (p. 352)
   Cephalic segment one-half shorter than rest of metasome, widest at its center; metasome obovate ---------- **venusta** (p. 353)

MALES

1. Genital segment four times length of abdomen; caudal rami longer than anal segment ---------- **venusta** (p. 353)
   Genital segment relatively much shorter; caudal rami shorter than anal segment ---------- 2
2. Genital segment twice as wide as abdomen, with straight sides and sharply pointed posterior corners ---------- **conifera** (p. 350)
   Genital segment three times as wide as abdomen, with strongly convex sides and bluntly rounded posterior corners ---------- **borealis** (p. 351)

ONCAEA CONIFERA Giesbrecht

FIGURE 210

Oncaea conifera GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 591, pl. 2, 47, 1892.

Occurrence.—Both sexes were taken in a surface tow at Station 20107, *Grampus*, off Georges Bank.

Distribution.—Arctic Ocean (Willey, Mrázek); Mediterranean (Claus); tropical Pacific (Giesbrecht); Red Sea, Indian Ocean

(Thompson and Scott); Antarctic Ocean (Brady); South Africa (Cleve, Stebbing); Adriatic (Steuer, Pesta); North Sea (van Breemen); Malay Archipelago (A. Scott); Greenland (Stephensen); North Atlantic (Cleve); California coast (Esterly).

Color.—Body only semitransparent, yellowish gray, the yellow deepest in the basal segments of the first antennae, the mouth parts, and the swimming legs. Front of the head and pigment spots on the metasome brick red; eggs orange.

Female.—Metasome elliptical, the width much less than half the length; second segment with a conspicuous hump on the dorsal midline; urosome less than one-third the length of the metasome; genital segment more than twice as long as abdomen; caudal rami as long as anal segment. End segment of second antenna nearly as long as middle segment, its two groups of setae widely separated. A conical projection between the two apical spines of the second, third, and fourth endopods; fifth leg cylindrical, its inner seta twice as long as the outer one. Total length, 0.75–1.25 mm.

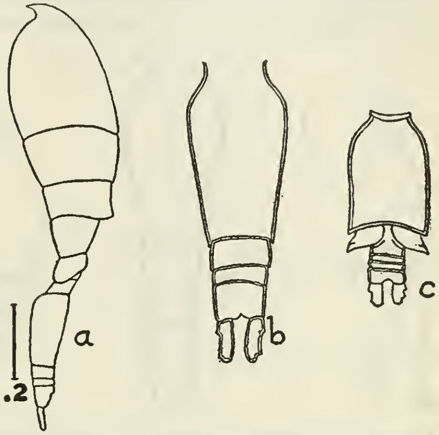

FIGURE 210.—*Oncaea conifera: a,* Female, lateral (after Giesbrecht); *b,* female, urosome; *c,* male, urosome

Male.—Considerably smaller than female, no dorsal hump on second metasome segment; genital segment three times as long as abdomen, lappets at its posterior corners large, triangular, sharply pointed, and turned outward. Fifth leg not articulated with the body segment, its apical setae very unequal. Total length, 0.6–0.8 mm.

Remarks.—The great inequality of the apical setae of the fifth legs is the best single character of this species. Its presence in both polar regions as well as in the Tropics shows that it can adapt itself to considerable changes in temperature.

ONCAEA BOREALIS G. O. Sars

FIGURE 211

Oncaea borealis SARS, Crustacea of Norway, vol. 6, p. 191, pl. 108, 1918.

Occurrence.—Several females were taken in a surface tow on Georges Bank, September 15, 1874.

Distribution.—Polar ocean, north of Siberia (Sars); British Isles (Brady); Norwegian coast (Sars).

Color.—Body transparent and colorless except for a faint tinge of yellow, which is deepest around the mouth and in the bases of the mouth parts and the swimming legs.

Female.—Metasome fusiform, two and one-third times as long as wide; second thoracic segment with a dorsal hump as in the preceding species. Urosome half the length of the metasome; genital segment scarcely longer than the abdomen, and tapered posteriorly; anal segment shorter than the two preceding segments combined; caudal rami much shorter than anal segment. Fifth leg rounded oval in form, its apical setae about the same length. Total length, 0.6–0.7 mm.

Male.—Much smaller and more slender than the female; second thoracic segment without a dorsal hump; urosome much less than half the length of the metasome; genital segment very large, three times the width and twice the length of the abdomen, lappets at its posterior corners short, bluntly rounded, and extending straight back; maxillipeds larger than those of the female, the apical claw smooth. Total length, 0.35–0.45 mm.

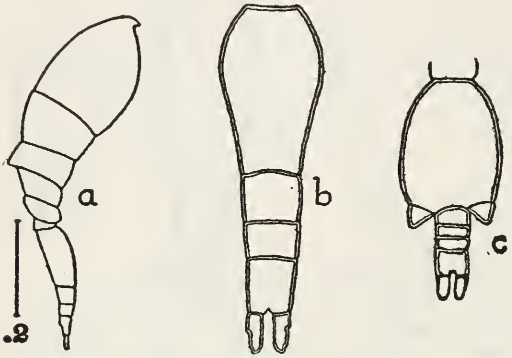

FIGURE 211.—*Oncaea borealis: a,* Female, lateral; *b,* female, urosome; *c,* male, urosome

Remarks.—Sars's separation of this species from *conifera* seems perfectly valid, and the two may be recognized by the characters given in the key above. This is more strictly a northern form, as is expressed in its specific name, and it has never been found much nearer the Tropics than in the present area.

ONCAEA MINUTA Giesbrecht

FIGURE 212

Oncaea minuta GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 591, pl. 47, 1892.

Occurrence.—Both sexes were obtained in a vertical haul at a depth of 1,000 meters, March, 1920, at Station 20069, *Grampus*, just south of Georges Bank.

Distribution.—North Atlantic (Cleve); Mediterranean (Giesbrecht); Indian Ocean (Thompson and Scott); Greenland coast (Stephensen); coast of Norway (Sars); coast of California (Esterly); Chesapeake Bay (Wilson).

Color.—Body semitransparent with a decided reddish tinge, deepest on the ventral surface; eggs red; eye not visible.

Female.—Metasome slender and fusiform, half as wide as long; second metasome segment without a dorsal hump; fifth segment exceptionally small. Urosome less than half the length of the metasome; genital segment about one-half longer than the abdomen, widest at the center; caudal rami shorter than the anal segment, but twice as long as wide, the outer seta at the center of the outer margin. Fifth leg as wide as long, the inner apical seta twice as long as the outer. Total length, 0.45–0.5 mm.

Male.—Unknown.

Remarks.—This is the smallest of the species here described and may be recognized by this fact alone if the specimen is mature; the head is also widest across its posterior margin. It is more of a pelagic species than the others and is captured at considerable depths, as indicated above.

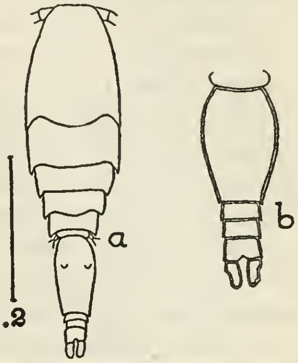

FIGURE 212.—*Oncaea minuta:* *a,* Female, dorsal; *b,* female, urosome

ONCAEA VENUSTA Philippi

FIGURE 213

Oncaea venusta PHILIPPI, Arch. Nat., Wiegmann, vol. 1, Jahrg. 9, p. 63, fig. 3, text, 1843.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 590, pls. 3, 47, 1892.

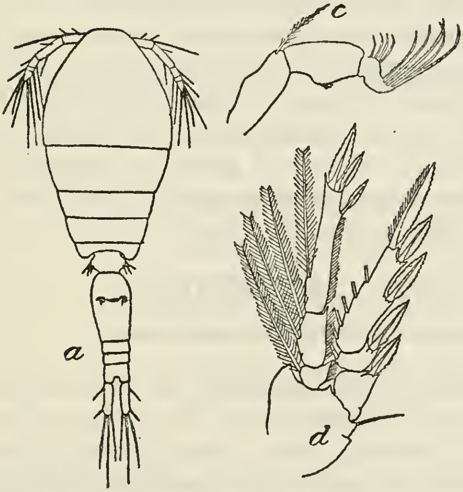

FIGURE 213.—*Oncaca venusta:* *a,* Female, dorsal; *b,* male, dorsal; *c,* second antenna of female; *d,* fourth leg of female. (From W. M. Wheeler)

Occurrence.—Two females taken in a surface tow, October 3, 1883, at Station 2101, *Albatross*, southeast of Nantucket; both sexes in surface tow on Georges Bank, September, 1874; both sexes in vertical haul at Station 20044, *Grampus*, February, 1920; both sexes in surface tow at Stations 2171 and 2194, *Albatross;* a single female in a surface tow in Menemsha Bight, Marthas Vineyard, August, 1926.

Distribution.—Palermo (Philippi); South Atlantic (Lubbock); Nizza (Claus); New Guinea, Philippine Islands, North Atlantic (Brady); Canary Islands, Malta (Thompson); North Atlantic (Cleve); South Africa (Cleve); Indian Ocean (Thompson and Scott); Sulu Sea (Dana); Adriatic (Pesta); Gulf Stream south of Marthas Vineyard (Wheeler); Chesapeake Bay (Wilson).

Color.—Body rather opaque, tinged with carmine-red, deepest in the cephalic and genital segments; chitin of the head and appendages violet; eggs blue, increasing in color with development.

Female.—Metasome obovate, the greatest width far in front of the center; urosome half the length of the metasome; genital segment but little longer than the abdomen; caudal rami as long as the last two abdominal segments combined, four times as long as wide. Outer exopod spines of first and second legs, 1, 1, 3, of third and fourth legs 1, 1, 2, each spine with a wide marginal membrane which is coarsely toothed. Fifth legs minute, as wide as long, the apical setae subequal. Total length, 1.1–1.27 mm.

Male.—Metasome narrower, but the greatest width still far forward; genital segment much enlarged, more than three times the length of the abdomen, the posterior lappets with small lateral points turned outward. First three abdominal segments very short and together hardly longer than the anal segment; caudal rami as long as the last three segments combined, converging distally; fifth leg minute and conical, its apical setae subequal. Total length, 0.8–0.95 mm.

Remarks.—This is the most abundant species of the genus in the area; it is pelagic in its habits and seems to prefer the surface. When alive it may be recognized by irregular spots of the carmine-red in the metasome, and by the blue eggs.

Family CORYCAEIDAE

Genus CORYCAEUS Dana, 1845

Body slender, subclavate, the metasome but little dilated; cephalic segment much longer that the rest of the metasome, carrying on the forehead two large corneal lenses, placed close together. Third metasome segment produced backward at each posterior corner in an acutely pointed lappet; fourth segment narrower than the third, sometimes fused with it dorsally, but with separate lappets. Urosome 2-segmented, the two sometimes fused into one; caudal rami narrow and elongate. First antennae 6-segmented; second antennae 3-segmented, prehensile; rami of first three pairs of legs and exopod of fourth pair 3-segmented; endopod of fourth pair 1-segmented; each fifth leg represented by two setae, unequal in length.

KEY TO THE SPECIES

FEMALES

1. Urosome 2-segmented, genital segment and abdomen separated ---- 2
   Urosome 1-segmented, genital segment and abdomen completely fused; caudal rami about half as long as urosome ---- elongatus (p. 355)
2. Genital opening with 1 or 2 setae; female with 2 ovisacs ---- 3
   Genital opening without setae; female with 1 ovisac ---- 4
3. Genital segment shorter than abdomen and caudal rami combined ---- venustus (p. 360)
   Genital segment longer than abdomen and caudal rami combined ---- obtusus (p. 356)
4. Caudal rami longer than entire urosome; lappets on third segment acuminate and reaching beyond end of genital segment ---- speciosus (p. 358)
   Caudal rami three-fifths as long as urosome; lappets on third segment acuminate and not reaching end of genital segment ---- danae (p. 359)
   Caudal rami half as long as urosome; lappets on third segment acute and reaching just beyond center of genital segment ---- ovalis (p. 359)

MALES

1. Genital segment with a tooth at anterior end on ventral midline ---- 2
   Genital segment rounded at anterior end, no tooth ---- 3
2. Genital segment longer than abdomen and caudal rami combined, with rounded lobes at its posterior corners ---- obtusus (p. 356)
   Genital segment three-fourths as long as abdomen and caudal rami, without lobes at its posterior corners ---- venustus (p. 360)
3. Inner margin of second segment of posterior antenna with a stout pointed tooth near its distal end ---- 4
   Inner margin of second segment of posterior antenna smooth, no tooth near its distal end ---- elongatus (p. 355)
4. Caudal rami half as long as urosome; genital segment obovate, widest considerably behind center ---- ovalis (p. 359)
   Caudal rami three-fourths as long as urosome; genital segment elliptical, widest at center ---- danae (p. 359)
   Caudal rami as long as urosome; genital segment notched on each lateral margin near posterior end ---- speciosus (p. 358)

CORYCAEUS ELONGATUS Claus

Figure 214

Corycaeus elongatus Claus, Die frei lebenden Copepoden, p. 157, pl. 24, figs. 3–4, 1863.—Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, p. 659, pls. 4, 49, 51, 1892.

Occurrence.—One female in surface tow on Georges Bank, September 15, 1874; both sexes in a vertical haul at Station 20048, *Grampus*, east of Chatham.

Distribution.—Gulf Stream south of Marthas Vineyard (Wheeler); Malay Archipelago (Cleve); Messina, Nizza (Claus); French coast (Gourret); South Atlantic, Mediterranean (Giesbrecht); North Atlantic (Cleve); Red Sea, Indian Ocean (Thompson and Scott); Adriatic (Steuer, Pesta); Chesapeake Bay (Wilson).

Color.—Body rather opaque, with a variable extent of red, yellowish-red, and yellow pigment, especially in the region of the mouth, in the winglike extensions of the posterior metasome segments, and in the genital segment; eye dark red; eggs yellowish, turning red with development.

Female.—Head separated from first segment; third and fourth segments fused dorsally, the lappets on the third segment not reaching the genital openings; genital segment and abdomen fused, spindle-shaped, widest through the genital openings, strongly tapered at both ends; caudal rami about half as long as urosome, and nearly parallel. Distal exopod segment of first three pairs of legs with three outer spines; endopod of fourth leg a small knob with one apical seta. Total length, 1.45–1.65 mm.

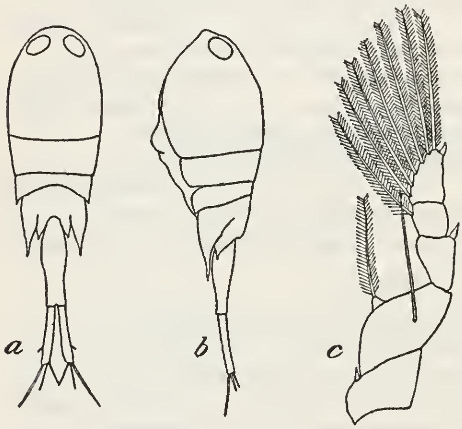

FIGURE 214.—*Corycaeus elongatus: a,* Female, dorsal; *b,* female, lateral; *c,* female, fourth leg. (From W. M. Wheeler)

Male.—Head more or less fused with first segment; genital segment and abdomen separated; posterior half of genital segment not tapered but forming prominent rounded corners, each with a stout plumose seta on its ventral surface; caudal rami half as long as urosome. The tooth on the inner margin of the second segment of the posterior antenna of the female replaced in the male by minute spinules. Total length, 1.3–1.4 mm.

Remarks.—Judged from the distribution given above, this is somewhat of a tropical species, and it probably comes into the present area by way of the Gulf Stream, in which it was found by Wheeler.

CORYCAEUS OBTUSUS Dana

FIGURE 215

Corycaeus obtusus DANA, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 39, 1849.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 659, pls. 4, 51, 1892.

Occurrence.—Both sexes were obtained in a surface tow at Station 2194, *Albatross*, south of Nantucket.

Distribution.—South Pacific, tropical Atlantic, Sulu Sea(Dana); Japan Sea, Philippines (Brady); Trieste (Car); Canary Islands, Malta (Thompson); French coast (Gourret); tropical Atlantic, Mediterranean (Giesbrecht); Arabian Sea, Indian Ocean, Malay Archipelago (Cleve); Red Sea, Arabian Sea (Thompson and Scott); North Atlantic (Cleve); Adriatic (Steuer, Pesta).

Color.—Female a grayish drab, with red pigment plentifully scattered along the lateral margins, in the epimeral lappets of the metasome, and across the head anteriorly and posteriorly. Corneal lenses brown, with a gray spot at the center; eye red; eggs green with a blue center and a gray outer shell. Male greenish blue, fading posteriorly into a light gray in the abdomen and caudal rami; large spots of light red in the posterior part of the head and the first and second segments; sperm ducts dark red.

Female.—Head separated from first segment; third and fourth segments fused, the lappets of the third segment reaching the center of the genital segment; lappets of fourth segment bluntly pointed at the tip; genital segment, anal segment, and caudal rami in the proportion of 24:9:10. Seta on basal segment of second antenna more than twice as long as the one on the second segment; endopod of fourth leg an elongate knob, with a single apical seta. Total length, 1–1.15 mm.

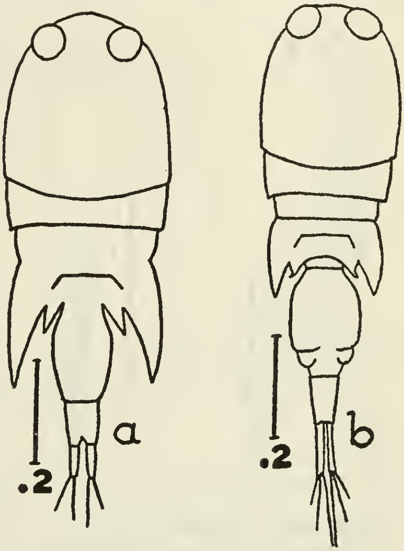

FIGURE 215.—*Corycaeus obtusus: a,* Female, dorsal (after Giesbrecht); *b,* male, dorsal

Male.—Body considerably more slender than in the female; head separated from the first segment; epimeral lappets of third segment spreading moderately; genital segment obcordate, with a broadly rounded lobe on each lateral margin near the posterior end; abruptly contracted behind these lobes to the width of the anal segment, so that the urosome appears at first glance 3-segmented; genital segment, anal segment, and caudal rami in the proportion of 20:8:10. Total length, 0.8–0.9 mm.

Remarks.—When alive this species may be recognized by its coloration, the two sexes being strongly contrasted. It is another tropical form and comes to the present area only by way of the Gulf Stream.

CORYCAEUS SPECIOSUS Dana

FIGURE 216

Corycaeus speciosus DANA, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 38, 1849.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 660, pl. 1892.

Occurrence.—Both sexes taken in the trawl wings at Station 2195, *Albatross*, south of Nantucket; one female in a surface tow, Station 2171, *Albatross;* two females in surface tow on Georges Bank, September, 1874.

Distribution.—Tropical Atlantic (Dana, Brady); Canary Isles, Malta (Thompson); tropical Atlantic and Pacific (Giesbrecht); Red Sea, Indian Ocean, Arabian Sea (Thompson and Scott); North Atlantic (Cleve); Mediterranean (Giesbrecht); South Africa (Stebbing); Chesapeake Bay (Wilson).

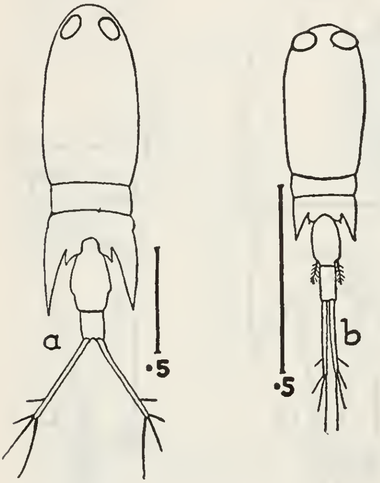

FIGURE 216.—*Corycaeus speciosus: a,* Female, dorsal (after Giesbrecht); *b,* male, dorsal

Color.—Body rather opaque, with pigment spots of red, yellowish red, and yellow scattered through it irregularly; eye red; eggs yellowish.

Female.—Head fused with first segment; third and fourth segments also fused; lappets on third segment reaching beyond the posterior margin of the genital segment and spreading somewhat; those of the fourth segment small and blunt. Genital segment spindle-shaped, considerably dilated through the center; caudal rami longer than the genital segment and abdomen combined, and divergent; endopod of fourth leg a short knob with one seta. Total length, 1.85–2.15 mm.

Male.—Body narrower than in the female; lappets of third segment not spreading and not reaching the center of the genital segment; lappets of fourth segment reduced to minute spines; genital segment with a notch, carrying a seta on each lateral margin near the posterior end; caudal rami as long as the genital segment and abdomen combined. Total length, 0.75–0.85 mm.

Remarks.—This is also a tropical species, but it has been reported by Cleve in the Atlantic as far north as latitude 50° N. The length of the caudal rami and that of the lappets on the third segment are distinguishing characters.

CORYCAEUS DANAE Giesbrecht

FIGURE 217

Corycaeus danae GIESBRECHT, Atti Accad. Lincei, Rome, ser. 4, vol. 7, p. 480, 1891; Fauna und Flora des Golfes von Neapel, vol. 19, p. 660, pl. 51, 1892.

Occurrence.—Two females were taken in a surface tow on Georges Bank, September, 1874.

Distribution.—Tropical Pacific (Giesbrecht); Arabian Sea, Red Sea, Indian Ocean, Mediterranean (Thompson and Scott); South Africa (Stebbing); Indian Ocean (Farran); North Atlantic (Cleve).

Color.—Unknown.

Female.—Head separated from first segment; third and fourth segments fused, lappets on the third segment not reaching posterior margin of the genital segment; lappets on fourth segment short and acuminate; genital segment elliptical, widest through the center; caudal rami three-fourths as long as urosome and divergent, obliquely truncated at the tip leaving the outer corner acute. Total length, 1.65–1.75 mm.

Male.—Body narrower than that of the female; head fused with first segment, widest at anterior end and tapered backward; third and fourth segments fused, the third lappets extending about to the center of the genital segment; fourth lappets short and mucronate. Genital segment elliptical, widest through the center, with smooth lateral margins, each bearing a plumose seta near the posterior end; caudal rami three-fourths as long as urosome and parallel. Total length, 1.3–1.4 mm.

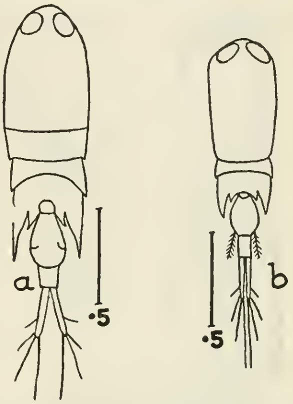

FIGURE 217.—*Corycaeus danae: a,* Female, dorsal (after Giesbrecht); *b,* male, dorsal

Remarks.—This species is pelagic and rare in the present area; its distinguishing characters are given in the key to the species, and with them may be included the size, this being one of the larger forms.

CORYCAEUS OVALIS Claus

FIGURE 218

Corycaeus ovalis CLAUS, Die frei lebenden Copepoden, p. 158, 1863.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 659, pls. 49, 51, 1892.

Occurrence.—Two females taken at the surface on Georges Bank, September, 1874; two females in a vertical haul at Station 20048, *Grampus*, east of Chatham.

Distribution.—Messina (Claus); Mediterranean (Giesbrecht); North Atlantic (Cleve); Red Sea, Indian Ocean (Thompson and Scott); Adriatic (Car, Steuer, Pesta).

Color.—Body rather opaque, with a varying extent of red and yellow pigment, especially around the mouth and in the bases of the appendages; eye red; eggs blue, the color deepening with development.

Female.—Head indistinctly separated from first segment; third and fourth segments fused, the third lappets broadly acuminate and reaching beyond the center of the genital segment; fourth lappets short and exceptionally broad, with acute points; second segment also with short acute lappets; genital segment, abdomen, and caudal rami in the proportion of 3:1:2. Seta on basal segment of second antenna much longer and stouter than the one on the second segment. Total length, 1.6–1.65 mm.

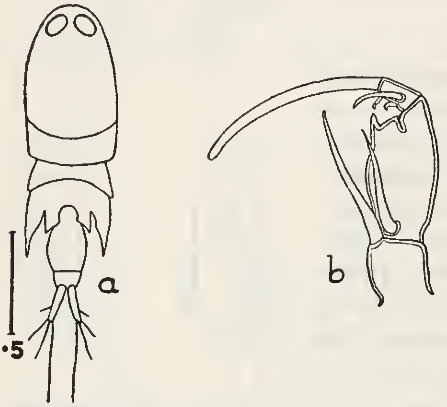

FIGURE 218.—*Corycaeus ovalis: a,* Female, dorsal, (after Giesbrecht); *b,* male, second antenna

Male.—Body much narrower than in the female; lappets of third segment not reaching center of genital segment; fourth lappets narrower; genital segment, abdomen, and caudal rami in the proportion of 4:2:3. Genital segment with a broadly rounded lobe on either side of the ventral surface near the posterior end, carrying the greatest width of the segment considerably behind the center. Total length, 1.3–1.4 mm.

Remarks.—This species has been reported in the Atlantic by Cleve as far north as latitude 45° N. The exceptional width of the lappets of the fourth segment is one of the best characters for recognition of the species.

CORYCAEUS VENUSTUS Dana

FIGURE 219

Corycaeus venustus DANA, Proc. Amer. Acad. Arts and Sci., vol. 2, p. 39, 1849.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 659, pls. 4, 51, 1892.

Occurrence.—Both sexes were taken in a surface tow on Georges Bank, September, 1874.

Distribution.—Kingsmill Islands (Dana); tropical Atlantic (Brady); tropical Pacific (Giesbrecht); Red Sea, Indian Ocean

(Thompson and Scott); Gulf of Guinea (T. Scott); California coast (Esterly).

Color.—Body rather opaque, with pigment spots of red and yellow irregularly distributed; they are especially numerous around the mouth, in the lappets of the third and fourth segments, and in the genital segment; eye red; corneal lenses red at the center and bluish around the margin; eggs bluish green.

Female.—Head more or less distinctly separated from the first segment; third and fourth segments sometimes fused, sometimes separated; metasome nearly twice the length of the urosome and caudal rami combined. Lappets of third segment scarcely reaching the center of the genital segment; those of the fourth segment relatively long. Genital segment barrel-shaped; caudal rami as long as the abdomen, five times as long as wide. Total length, 0.8–1 mm.

Male.—Head separated from first segment; third and fourth segments fused; lappets of the third segment reaching the center of the genital segment, those of the fourth segment shorter than in the female. Genital segment three-fourths as long as the abdomen and caudal rami combined. Front of head flattened so that the corneal lenses point forward rather than upward. Total length, 0.7–0.8 mm.

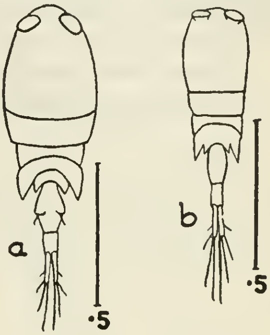

FIGURE 219.—*Corycaeus venustus: a,* Female, dorsal (after Giesbrecht); *b,* male, dorsal

Remarks.—When alive this species can be recognized by the contrasting red and blue colors in the corneal lenses; the distinguishing characters of preserved specimens are given in the key; in the female also the proportional lengths of the genital segment, abdomen, and caudal rami are 3:2:2.

Genus CORYCELLA Farran, 1911

Head fused with first segment, with a pair of corneal lenses on the forehead as in the preceding genus; third and fourth segments fused, the fourth segment without separate epimeral plates; genital segment and abdomen fused. Ventral process between the maxillipeds and first legs beak-shaped, the beak pointing backward. First antennae 6-segmented; second antennae 4-segmented, prehensile, the inner margin of the second segment not toothed. Rami of first four pairs of legs 3-segmented, except the fourth endopod, which is lacking; the four exopods with 0, 0, 0, 1 outer spines; fifth legs entirely obsolete. A single species. (See Appendix B, p. 594.)

CORYCELLA CARINATA (Giesbrecht)

FIGURE 220

Corycaeus carinatus GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 661, pl. 51, 1892.

Corycella carinata FARRAN, Proc. Zool. Soc. London, 1911, p. 286, pl. 11, fig. 10.

Occurrence.—Both sexes taken in a vertical haul at Station 20048, *Grampus*, east of Monomoy Lighthouse.

Distribution.—Tropical Pacific (Giesbrecht); Mediterranean, Indian Ocean (Thompson and Scott); California coast (Esterly); Chesapeake Bay (Wilson); Gulf Stream south of Marthas Vineyard (Wheeler); Christmas Island, Indian Ocean (Farran).

Color.—Body opaque with a variable extent of red, orange, and yellow pigment distributed very irregularly, but usually concentrated around the mouth on the ventral surface, in the epimeral lappets, and on the dorsal surface of the genital segment; eye dark red; eggs orange.

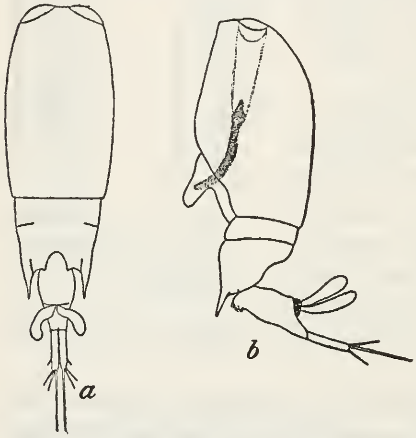

FIGURE 220.—*Corycella carinata: a*, Female, dorsal; *b*, female, lateral. (From W. M. Wheeler)

Female.—Head completely fused with the first segment, the forehead flattened so that the corneal lenses appear in profile in dorsal view; second, third, and fourth segments fused dorsally and concealing the fifth segment, so that the metasome appears 2-segmented in dorsal view. Lappets on the third segment acuminate and reaching beyond the center of the urosome; no lappets on fourth segment. The 1-segmented urosome widest near the front; caudal rami half as long as urosome, four times as long as wide. Total length, 0.86–0.92 mm.

Male.—Head fused with first segment, the corneal lenses projecting from the forehead almost in hemispheres; metasome apparently 2-segmented as in the female; urosome spindle-shaped, strongly tapered anteriorly and posteriorly, widest at the center, two and a half times as long as the caudal rami; the latter 10 times as long as wide. Total length, 0.75–0.8 mm.

Remarks.—As this is the only species in the present area with a ventral beak, this character alone will identify it. It is evidently a tropical form and must be regarded as another straggler coming by way of the Gulf Stream.

Genus SAPPHIRINA J. V. Thompson, 1829

Head separated from first segment, with a pair of corneal lenses on the forehead; entire body strongly depressed; metasome much widened, with or without lateral epimeral plates in the female, always with them in the male; fifth segment abruptly narrowed to half the width of the fourth, or less. Urosome 5-segmented, much narrower than metasome in female, little if any narrower in the male; abdominal segments with epimeral plates in both sexes; caudal rami broadly laminate, with no elongated setae. First antennae 3- to 6-segmented; second antennae 4-segmented, prehensile; rami of first four pairs of legs 3-segmented; fifth legs uniramose, 1-segmented, each with two minute apical setae.

Remarks.—The males of this genus are remarkable for their wonderful iridescence, the dorsal surface of the body displaying a metallic brilliancy, which surpasses that of any other copepod. After careful histological examination Doctor Ambronn concluded that these are not the spectral colors of a grating, but are interference colors produced by a layer of closely set uniaxial, anisotropic prisms just beneath the chitin integument.[13]

KEY TO THE SPECIES

FEMALES

1. Endopod and exopod of fourth legs subequal ---- 2
   Endopod of fourth leg half as long as exopod, or less ---- 7
2. Each caudal ramus with a broad, bluntly rounded process at its inner distal corner, reaching beyond tip of ramus ---- angusta (p. 364)
   Each caudal ramus with a slender process or spine at its inner distal corner, not reaching tip of ramus ---- 3
3. Metasome broadly ovate, one-half longer than wide, and nearly or quite three times as wide as urosome ---- 4
   Metasome elongate ovate, twice as long as wide, and scarcely more than twice as wide as urosome ---- 5
4. Fourth segment of second antenna twice as long as third, the two together the same length as second segment ---- auronitens (p. 365)
   Fourth segment of second antenna one-half longer than third, the two together half as long as second segment ---- pyrosomatis (p. 366)
5. Head about equal in length and width; third and fourth segments of second antenna together three-fourths as long as second segment ---- gemma (p. 368)
   Head definitely wider than long ---- 6
6. Fourth segment of second antenna same length as third, the two together half as long as second segment ---- ovatolanceolata (p. 369)
   Fourth segment of second antenna distinctly longer than third, the two together four-fifths as long as second segment ---- vorax (p. 370)
7. Metasome broadly ovate, only one-fourth longer than wide; third segment abruptly narrowed to two-thirds the width of second segment ---- scarlata (p. 371)
   Metasome elongate ovate, one-half longer than wide; third segment but little narrower than second ---- nigromaculata (p. 372)

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[13] Mittheil Zool. Stat. Neapel, vol. 9, p. 365, 1890.

MALES

1. Third and fourth metasome segments as wide as head or wider; corneal lenses not visible in dorsal view ________ 2
   Third and fourth metasome segments definitely narrower than head; corneal lenses visible in dorsal view ________ 4
2. Endopod of fourth leg a little shorter than exopod; end segment only three-fourths as long as two basal segments together ________ **angusta** (p. 364)
   Endopod of fourth leg a little longer than exopod; end segment fully as long as two basal segments together ________ 3
3. Third and fourth segments of second antenna together half as long as second segment; apical claw half as long as fourth segment ________ **ovatolanceolata** (p. 369)
   Third and fourth segments of second antenna together two-thirds as long as second segment; apical claw one-third as long as fourth segment ________ **gemma** (p. 368)
4. Head twice as wide as long or more; caudal rami one-half longer than wide or less ________ 5
   Head one-half wider than long or less; caudal rami twice as long as wide or more ________ 6
5. Second antennae stout, fourth segment two and a half times as long as the third, the two together longer than second segment ________ **scarlata** (p. 371)
   Second antennae slender, fourth segment four times as long as third, the two together as long as second segment ________ **nigromaculata** (p. 372)
6. Caudal rami one-fourth longer than wide; first antennae less than half as long as second pair ________ **auronitens** (p. 365)
   Caudal rami three times as long as wide; first antennae three-fourths as long as second pair ________ **pyrosomatis** (p. 366)

SAPPHIRINA ANGUSTA Dana

FIGURE 221

Sapphirina angusta DANA, United States Exploring Expedition, 1838–1842 (Wilkes), vol. 14, Crustacea, p. 1240, 1853, pl. 87, fig. 3, 1855.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 619, pl. 52, 53, 54, 1892.

Occurrence.—Both sexes taken in surface tow at Station 1107, *Fish Hawk*, Gulf Stream south of Nantucket.

Distribution.—Kerguelen Islands (Dana); tropical Atlantic (Lubbock); Messina, Madagascar, coast of Argentina (Brady); Malta (Thompson); Mediterranean, Hawaiian Islands (Giesbrecht); Adriatic (Steuer, Pesta); California coast (Esterly); Malay Archipelago (A. Scott).

Color.—Body of female almost colorless and semitransparent; ovaries, oviducts, and ovisacs bluish; digestive canal faintly bluish, the color deeper in the anterior portion; young females almost perfectly transparent and colorless; males brilliantly iridescent (Rathbun).

Female.—Head one-half longer than wide, narrowed anteriorly, the entire anterior end occupied by the corneal lenses; urosome one-third the length of the metasome; caudal rami twice as long as wide, a broad and bluntly rounded process at the inner distal corner, which extends its entire length beyond the tip of the ramus. First antenna 5-segmented, the second segment longer than the three terminal segments combined; third and fourth segments of second antenna shorter than the second segment; fourth endopod shorter than the exopod, with two apical flanged spines of equal length. Total length, 3.25–4 mm.

Male.—Body two and one-fourth times as long as wide; first four free segments each wider than the head, the second segment the widest; corneal lenses invisible in dorsal view. End segment of second endopod with three inner setae, three lanceolate flanged spines and two clawlike spines around the tip, the largest lanceolate spine on the outer margin, with a small secondary spine outside its base. Total length, 3.75–5.15 mm.

Remarks.—This species is easily recognized by its exceptional length in comparison with its breadth and by the broad process at the inner corner of the caudal ramus. Judged from the distribution given above, it is evidently a tropical form, brought up to the southern limit of the present area in the Gulf Stream. Rathbun noted great quanities of *Salpa caboti* in the same towing, and probably this is the host of the species.

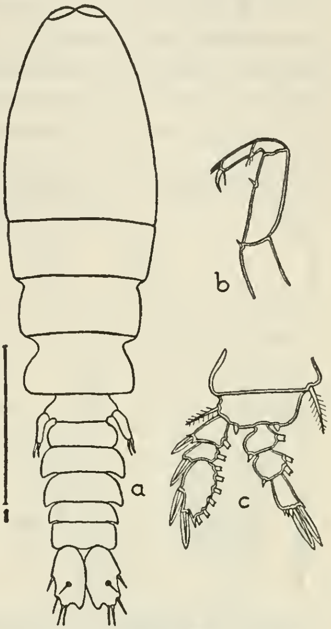

FIGURE 221.—*Sapphirina angusta:* *a*, Female, dorsal; *b*, second antenna of female; *c*, fourth leg of female

SAPPHIRINA AURONITENS Claus

FIGURE 222

Sapphirina auronitens CLAUS, Die frei lebenden Copepoden, p. 153, 1863.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 619, pls. 4, 53–54, 1892.

Occurrence.—Both sexes were obtained in a surface tow at Stations 1107 and 1108, *Fish Hawk*, south of Nantucket; both sexes also in a surface tow on Georges Bank, September, 1874.

Distribution.—Messina (Claus, Haeckel); Naples (Giesbrecht); Adriatic (Steuer, Pesta); Indian Ocean (Thompson and Scott); Malay Archipelago (A. Scott).

Color.—General body color bluish gray, finely reticulated with black lines on the dorsal surface. The meshes of this network are very irregular in size and shape, but are more often diamond-shaped and transversely elongate. Along the frontal and lateral margins of the head and the sides of the thoracic segments are bright red dots, sometimes arranged in rows parallel with the margins, sometimes scattered about irregularly. Similar dots run down the median line of the genital segment and abdomen, and there is a single transverse row across the anal segment. Along each side of the digestive canal in the metasome is a yellow longitudinal band, which becomes red in the genital segment and abdomen. The pigment of the retina and optic nerve is dark bluish green, almost black; the appendages are bluish gray like the body; the ovisacs are deep blue (Rathbun).

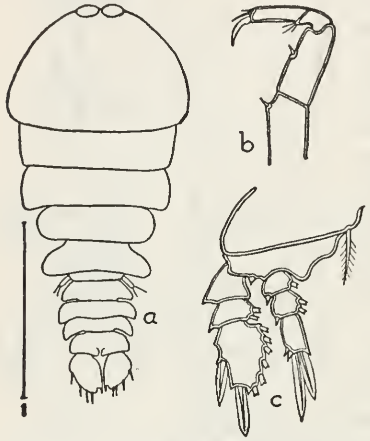

Figure 222.—*Sapphirina auronitens:* *a,* Female, dorsal; *b,* female, second antenna; *c,* female, fourth leg

Female.—Head two-fifths wider than long, projecting slightly at the posterior corners; second segment wider than the first, with rounded corners; third segment abruptly narrowed to three-fourths the width of the second segment; fifth segment half the width of the fourth. Caudal rami obovate, inclined toward the midline, with a minute aculeate spine on the inner margin near the tip. Fourth segment of second antenna twice as long as third, the two together the same length as the second segment. Fourth endopod with two unequal apical spines. Total length, 1.75–2.15 mm.

Male.—Total length of body to greatest width as 5:3; corneal lenses just visible in dorsal view; second metasome segment narrower than first; third segment not abruptly narrowed. End segment of second endopod with a large lanceolate flanged spine on the outer margin, three toothed apical spines, a curved claw at the inner distal corner, three inner setae, and three short spines around the apex. Total length, 1.35–2.25 mm.

Remarks.—This species is also a straggler from the Tropics in the Gulf Stream and was taken in company with the same *Salpa* as the preceding species.

SAPPHIRINA PYROSOMATIS Giesbrecht

Figure 223

Sapphirina pyrosomatis Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, p. 619, pls. 4, 52–54, 1892.

Occurrence.—Both sexes were taken with the two preceding species in a surface tow at Station 1107, *Fish Hawk*, south of Nantucket; a single female was also captured in the trawl wings at a depth of 1,058 fathoms in the same vicinity August 5, 1884.

Distribution.—Mediterranean (Giesbrecht).

Color.—Body colorless and more or less transparent; digestive canal rust colored in the living copepod, according to Giesbrecht; in the present specimens, preserved in alcohol, the digestive canal is dark blue; eye black. Male brilliantly iridescent, the play of colors extending even to the caudal rami, but omitting the anal abdominal segment. (Rathbun.)

Female.—Metasome obovate, with rather even margins; head one-third wider than long; corneal lenses small and well separated; fifth segment one-half the width of the fourth; the latter with a rounded prominence on the dorsal midline at the posterior margin; caudal rami three times as long as wide, with a minute spine on the inner margin near the tip. Fourth segment of second antenna only one-half longer than the third, the two together but little more than half as long as the second segment; the two apical spines on the fourth endopod slender and subequal. Total length, 2–2.25 mm.

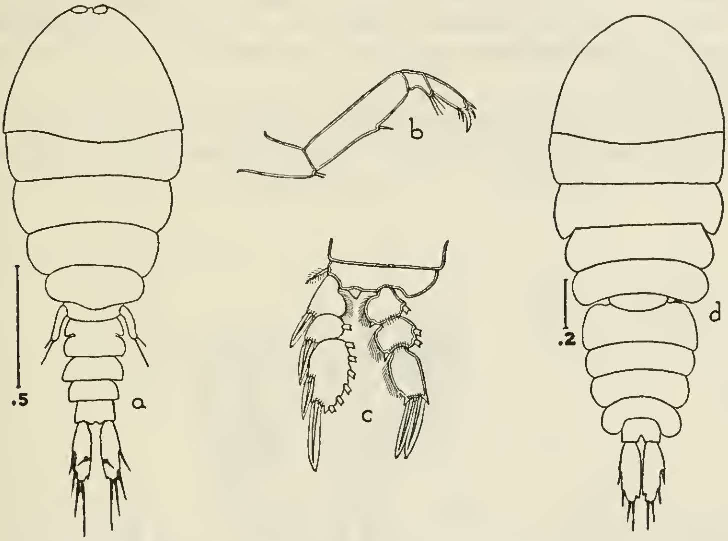

FIGURE 223.—*Sapphirina pyrosomatis: a,* Female, dorsal; *b,* female, second antenna; *c,* female, fourth leg; *d,* male, dorsal

Male.—Head one-third wider than long, narrowed anteriorly; corneal lenses invisible in dorsal view; second thoracic segment with rounded epimeral plates at its posterior corners. End segment of second endopod with one lanceolate spine, two awl-shaped spines sparsely toothed, a long curved claw, and three small spines. Total length, 1.75–2.15 mm.

Remarks.—The projecting prominence on the dorsal midline of the fourth segment is the most prominent character of the present species and is very distinct in these preserved specimens. Giesbrecht said that the caudal rami were at least twice as long as wide in the Mediterranean specimens; in these American specimens the length is nearly three times the width. Rathbun's specimens were collected long before those on which Giesbrecht established the species and are the first to be reported outside of the Mediterranean.

SAPPHIRINA GEMMA Dana

FIGURE 224

Sapphirina gemma DANA, United States Exploring Expedition, 1838–1842 (Wilkes), vol. 14, Crustacea, p. 1252, 1853, pl. 88, figs. 1, 2, 1855.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 618, pls. 3, 52–54, 1892.

Occurrence.—Both sexes were taken in surface tows at Stations 949, 1107, 1108, *Fish Hawk*, south of Marthas Vineyard; eight males were captured in a surface tow in Vineyard Sound, August 5, 1871.

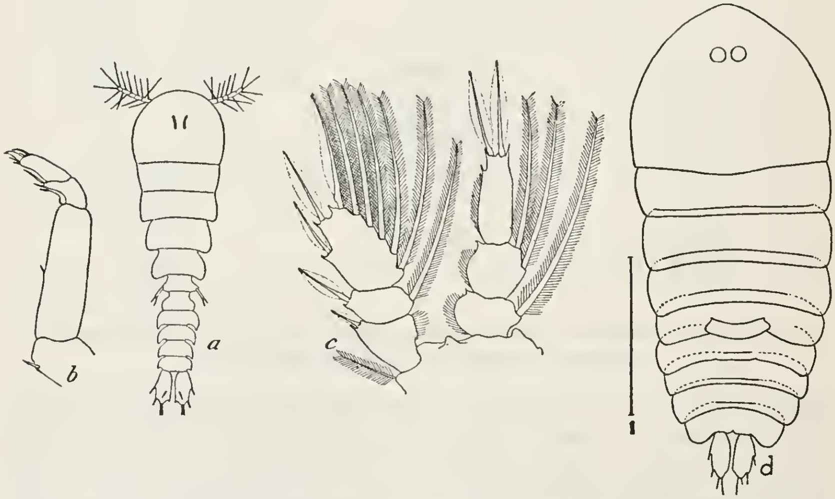

FIGURE 224.—*Sapphirina gemma: a,* Female, dorsal; *b,* female, second antenna; *c,* female, fourth leg. (From W. M. Wheeler.) *d,* Male, dorsal

Distribution.—New Zealand (Dana); Gulf of Guinea (Lubbock); Nizza, Messina, Naples (Claus); Malta (Thompson); Mediterranean, tropical Atlantic (Giesbrecht); Adriatic (Steuer, Pesta); North and South Atlantic (Brady); Arabian Sea (Cleve); Chesapeake Bay (Wilson); Gulf Stream south of Nantucket (Wheeler).

Color.—Body of female dark gray with scattered red dots along the lateral margins of the entire body, interspersed with a few black dots; ovaries, oviducts, and ovisacs a deep greenish blue, the two former covering a large part of the dorsal surface of the metasome; appendages and caudal rami the same color as the body. In the male the body is iridescent, showing all the colors of the rainbow, and in addition gold and silver. (Rathbun.)

Female.—Head a little wider than long, the greatest width just behind the center; corneal lenses invisible in dorsal view; metasome segments squarely truncated posteriorly, with projecting corners; fifth segment half the width of the fourth, considerably dilated through its center; caudal rami about twice as long as wide. Third and fourth segments of second antenna the same length, the two together much shorter than the second segment; fourth endopod longer than the exopod, its two apical setae subequal. Total length, 1.9–3.15 mm.

Male.—Head a little wider than long; corneal lenses on the ventral surface some distance behind the frontal margin; urosome nearly as wide as metasome. Terminal segment of second endopod with three large lanceolate flanged spines, three setae and four small spines around the apex. Total length, 2.15–3.15 mm.

Remarks.—This is another tropical straggler coming into the area by way of the Gulf Stream, but the eight males taken in Vineyard Sound show that it occasionally drifts a long way out of the Gulf Stream. Wheeler's specimens were found in company with chains of *Salpa cordiformis*, and this tunicate may be taken as the probable host of the present species.

SAPPHIRINA OVATOLANCEOLATA Dana

FIGURE 225

Sapphirina ovatolanceolata DANA, United States Exploring Expedition, 1838–1842 (Wilkes), vol. 14, Crustacea, p. 1251, 1853, pl. 87, figs. 15–16, 1855.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 618, pls. 1, 52–54, 1892.

Occurrence.—Several adult and two young females were taken in a surface tow at Stations 1107 and 1108, *Fish Hawk*, south of Marthas Vineyard.

Distribution.—Rio de Janeiro (Dana); Messina (Gagenbaur, Haeckel); Gulf of Guinea (Lubbock); Malay Archipelago (A. Scott); Nizza (Claus); Mediterranean, tropical Atlantic (Giesbrecht); South Atlantic (Cleve); Red Sea, Indian Ocean (Thompson and Scott); Adriatic (Pesta).

Color.—Body of the female colorless and semitransparent, often with flecks of reddish-brown pigment near the margins of the head, thoracic segments, and caudal rami; ovaries, oviducts, and ovisacs blue; digestive canal grayish blue. The male, as pictured by Giesbrecht in his colored plate (loc. cit., pl. 1, figs. 7–8), is by far the most gorgeous copepod in his entire collection. The dorsal surface is reticulated and brilliantly iridescent, the meshes filled with all the colors of the rainbow indiscriminately arranged. In general the head and the middle of the thorax contain the reds and yellows, while the margins of the thorax and the urosome contain the blues and greens. The caudal rami are not iridescent, but are sometimes colorless and sometimes spotted with red. (Rathbun.)

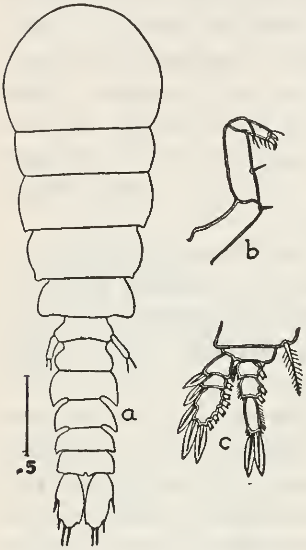

Figure 225.—*Sapphirina ovatolanceolata: a,* Female, dorsal; *b,* female, second antenna; *c,* female, fourth leg

Female.—Head wider than long; widest just behind the center; second segment as wide as the first and considerably longer, the rest of the body tapered; caudal rami twice as long as wide. Third and fourth segments of second antenna the same length, the two together half as long as the second segment; fourth endopod longer than the exopod, its two apical spines equal. Total length, 2.4–2.85 mm.

Male.—Head wider than long, narrowed anteriorly; corneal lenses on the ventral surface some distance behind the frontal margin; second antennae longer and more slender than in the female, the last two segments together nearly as long as the second segment. Terminal segment of second endopod with three large lanceolate flanged spines, three inner setae, two curved claws, and two small spines around the apex. Total length, 3.5–3.8 mm.

Remarks.—The present record of the species is the farthest away from the Tropics it has thus far been found. The transfer of the corneal lenses to the ventral surface of the head in both sexes is an important character.

SAPPHIRINA VORAX Giesbrecht

Figure 226

Sapphirina vorax Giesbrecht, Fauna und Flora des Golfes von Neapel, vol. 19, p. 619, pls. 3, 52–54, 1892.

Occurrence.—Taken in surface tows at Stations 925, 951, 1028, 1031, 1039, *Fish Hawk*, south of Marthas Vineyard in the Gulf Stream.

Distribution.—Indian Ocean (Giesbrecht); northern Atlantic (Cleve); Mediterranean, tropical Atlantic (Giesbrecht); Malay Archipelago (Cleve).

Color.—Body of female faint yellowish white, with transparent rounded spots near the lateral margins of each segment; anal segment and caudal rami colorless; front half of head whitish from the presence of large white granules with transparent interspaces; posterior half of head yellowish, with a large transparent spot near each lateral margin; last thoracic segment with the color only through the center, the sides being wholly transparent; eggs bluish white.

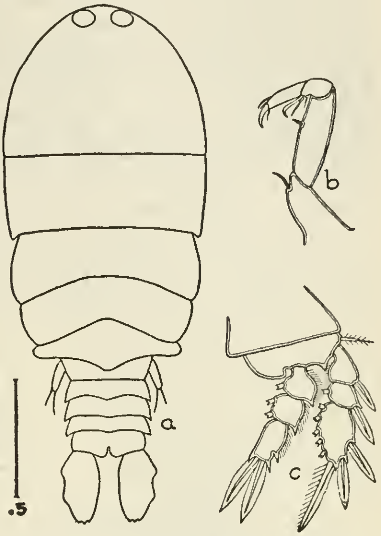

FIGURE 226.—*Sapphirina vorax: a,* Female, dorsal; *b,* female, second antenna; *c,* female, fourth leg

Female.—Head wider than long; corneal lenses well separated and entirely visible on the frontal margin; first three segments as wide as the head, fourth segment slightly narrower, with a rounded projection on the dorsal midline at the posterior margin; caudal rami two-thirds longer than wide. Fourth segment of second antenna considerably longer than the third segment, the two together two-thirds as long as second segment; endopod of fourth leg shorter than exopod, its two apical setae very large and equal. Total length, 1.9–2.15 mm.

Male.—Unknown.

Remarks.—The dorsal hump on the fourth segment is similar to that on *pyrosomatis* and is one of the best recognition characters. This species has never before been reported from American shores.

SAPPHIRINA SCARLATA Giesbrecht

FIGURE 227; PLATE 1, *e*

Sapphirina scarlata GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 620, pls. 52–54, 1892.

Occurrence.—Both sexes were obtained from surface hauls at Stations 1107 and 1108, *Fish Hawk*, south of Marthas Vineyard.

Distribution.—Galapagos Islands (Giesbrecht); South Atlantic (Cleve); Malay Archipelago (A. Scott); California coast (Esterly).

Color.—The body of the female is colorless and transparent, with bright-red spots scattered over the dorsal surface near the lateral margins; these show no definite arrangement, and vary in size, but are all fairly circular in outline. The male is brilliantly iridescent, except the fifth thoracic segment, the anal segment, and the caudal rami; the dorsal surface is reticulated, the meshes of the network more or less angular. The yellows predominate along the margins and the reds through the center of the metasome, while the center of the urosome and the posterior portion of the thoracic segments are bluish green, deepened in places almost to black (Rathbun).

Female.—Head wider than long, widest at the posterior margin; corneal lenses a little behind the frontal margin and in contact with each other; first segment narrower than the head; second segment wider than the first; third segment abruptly narrowed to two-thirds the width of the second segment; fourth segment as wide as the third; fifth segment less than half the width of the fourth; caudal rami twice as long as wide. Fourth endopod only half as long as exopod, its two apical setae equal. Total length, 3–3.35 mm.

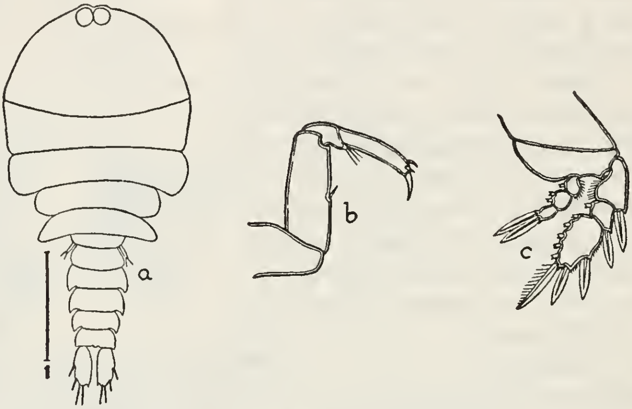

FIGURE 227.—*Sapphirina scarlata: a,* Female, dorsal; *b,* female, second antenna; *c,* female, fourth leg

Male.—Head nearly twice as wide as long; corneal lenses separated on the frontal margin; body behind the head regularly tapered, the lateral margins much smoother than in the female. Terminal segment of the second endopod with two lanceolate flanged spines, a denticulate awl-shaped spine and three small processes around the apex. Total length, 3.4–3.8 mm.

Remarks.—The broken lateral margins in the female, on account of the varying widths of the body segments, are characteristic, as also is the shortened fourth endopod. This is the first record of the species from this side of the Atlantic, and like the preceding species it comes from the Tropics by way of the Gulf Stream.

SAPPHIRINA NIGROMACULATA Claus

FIGURE 228

Sapphirina nigromaculata CLAUS, Die frei lebenden Copepoden, p. 152, pl. 8, 1863.—GIESBRECHT, Fauna und Flora des Golfes von Neapel, vol. 19, p. 619, pls. 52–54, 1892.

Occurrence.—Both sexes found in abundance in a surface tow at Stations 1107 and 1108, *Fish Hawk*, south of Marthas Vineyard.

Distribution.—Messina (Claus, Haeckel); Canary Isles, Malta (Thompson); Mediterranean, tropical Atlantic (Giesbrecht); Adriatic (Steuer, Pesta); North Atlantic (Cleve); Red Sea, Indian Ocean (Thompson and Scott); Malay Archipelago (A. Scott).

Color.—Body transparent and almost colorless, but spotted on the dorsal surface with dark-brown pigment. The spots are arranged in rows of five across the center of each abdominal segment, two on each side, and one on the midline. In the genital segment the one on the midline disappears; in the head and first four thoracic segments the color spots are more numerous, but are irregularly arranged and of different sizes. In the female the spots on the urosome are lacking, but those on the metasome are still distinct after 45 years in alcohol.

Female.—Head one-half wider than long, widest at the posterior margin; first and second thoracic segments as wide as the head; third and fourth segments tapered regularly backward; fifth segment abruptly narrowed to half the width of the fourth; caudal rami twice as long as wide. Fourth segment of second antenna three times as long as the third segment, the two together the same length as the second segment. The endopod of the fourth leg not half so long as the exopod, its two apical spines equal and very slender. Total length, 1.9–2 mm.

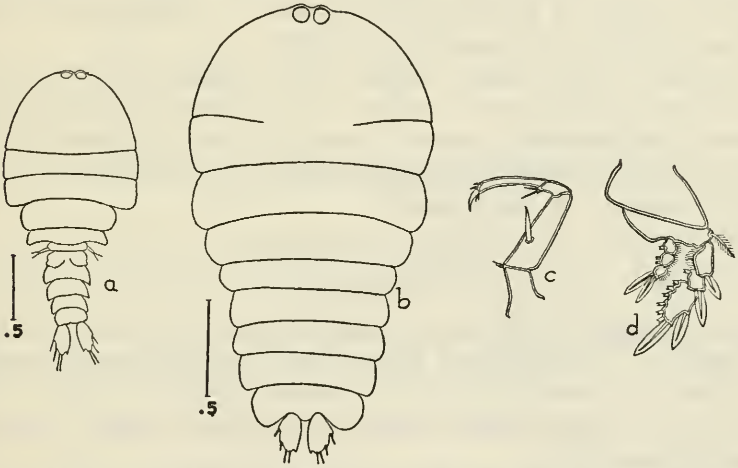

FIGURE 228.—*Sapphirina nigromaculata: a,* Female, dorsal (drawn by Rathbun); *b,* male, dorsal; *c,* female, second antenna; *d,* female, fourth leg

Male.—Head twice as wide as long; corneal lenses visible on the frontal margin in dorsal view. The two terminal segments of the second antenna are together about one-fourth longer than the second segment; the terminal segment of the second endopod has two lanceolate flanged spines, one awl-shaped dentate spine, and two small spines around the apex. Total length, 2.05–2.45 mm.

Remarks.—When alive this species may be recognized by its spots, which still persist in preserved material, and also by the great reduction in size of the fourth endopods. The species has never before been reported from our American shores, and though found in greater numbers than some of the preceding species, it is probably like them a mere straggler from the south.

Genus COPILIA Dana, 1849

Body of female transparent and strongly depressed; head fused with first segment, squarely truncated anteriorly, with a pair of knob-like corneal lenses near the corners. Posterior margin of fourth segment with a stout median spine pointed backward; urosome 4-segmented, the genital segment being divided by a median groove; caudal rami much longer than the urosome. First antennae 6-segmented; second antennae 4-segmented; rami of first three pairs of legs and exopod of fourth pair 3-segmented; fourth endopod 1-segmented; fifth leg uniramose, 1-segmented.

The male is very similar to the male of *Sapphirina;* head separated from first segment, without corneal lenses; body segments widened and flattened; posterior margin of fourth segment with a median knob; urosome 5-segmented; caudal rami rodlike and shorter than in female. A single species.

COPILIA MIRABILIS Dana

FIGURE 229

Copilia mirabilis DANA, United States Exploring Expedition, 1838–1842 (Wilkes), vol. 14, Crustacea, p. 1232, 1853 pl. 86, 1855.—BRADY, Voyage of H. M. S. *Challenger*, vol. 8, pt. 23, Copepoda, p. 117, pl. 53, 1883.

Occurrence.—Taken in a surface tow at Station 2223, *Albatross*, south of Nantucket.

Distribution.—Kingsmill Islands, Pacific (Dana); Cape Verde Islands (Lubbock); North Atlantic (Brady, Cleve); Canary Islands, Malta (Thompson); Indian Ocean, Pacific (Giesbrecht); Malay Archipelago (Cleve); Mediterranean, Gulf of Suez, Red Sea (Thompson and Scott).

Color.—Body as transparent and colorless as glass, the only pigment appearing in the unpaired eye, which is ruby red.

Female.—Head quadrangular, widened posteriorly, with reentrant lateral margins and as long as the rest of the body excluding the caudal rami; third and fourth segments each with a median dorsal spine. Posterior margins of urosome segments denticulate; anal segment twice as long as the rest of the urosome and somewhat dilated distally; caudal rami linear, half as long as the body, divergent, with very short apical setae. Second antenna with a stout apical claw; spine on second segment of this antenna furcate; fifth legs two small knobs, each with a single apical seta. Total length, 3.25–3.5 mm.

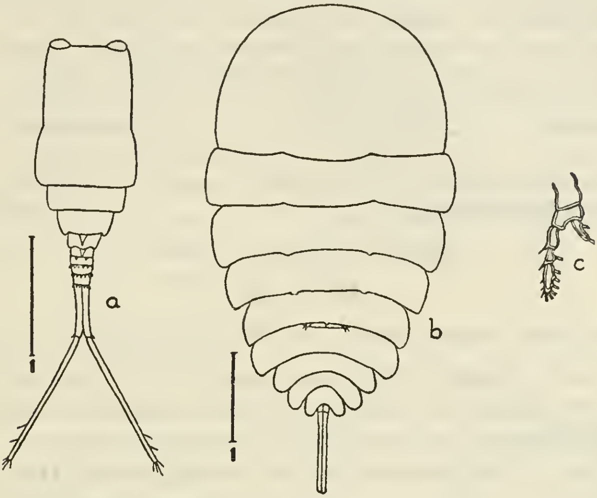

FIGURE 229.—*Copilia mirabilis: a,* Female, dorsal; *b,* male, dorsal; *c,* male, fourth leg (after Brady)

Male.—Head separated from first segment; first and second free segments wider than the head, the rest of the body tapered backward; second antenna very slender, the proportionate lengths of its segments as 9:8:5:8; spine on inner margin of second segment falcate and unbranched. Total length, 5.25–5.5 mm.

Family ERGASILIDAE

Genus ERGASILUS Nordmann, 1832

Body cyclopslike, narrowed posteriorly; head sometimes fused with, sometimes separated from, the first segment; urosome 4-segmented in female, 5-segmented in male, one-third as long as metasome or less; caudal rami short. First antennae 6-segmented; second antennae 3-segmented, the apical claw greatly enlarged and used for prehension; mouth parts removed some distance behind the second antennae; mandibles setose; maxillipeds entirely lacking in the female, present and strongly developed in the male. Rami of first four pairs of legs 3-segmented, except the fourth exopods, which are sometimes 1- or 2-segmented; fifth legs uniramose, 1-segmented, rarely obsolete. Two ovisacs, eggs small and numerous. Females parasitic on the gills of fish, males free swimmers; found in both fresh and salt water.

KEY TO THE SPECIES (FEMALES)

1. Exopod of fourth leg 3-segmented; second antenna without sleeves, claw not toothed -- 2
   Exopod of fourth leg 2-segmented; second antenna with large sleeves inclosing bases of second and third segments -- manicatus (p. 376)
   Exopod of fourth leg 1-segmented; terminal claw of second antenna with several small teeth near base of inner margin - labracis (p. 377)
2. Basal segment of second antenna with convex outer margin, much wider than second segment; apical claw with smooth inner margin ------------------------------ centrarchidarum p. 377)
   Basal segment of second antenna with straight outer margin, much narrower and shorter than second segment; apical claw with large inner tooth ------------------------------ funduli (p. 378)

ERGASILUS MANICATUS Wilson

Figure 230

Ergasilus manicatus Wilson, Proc. U. S. Nat. Mus., vol. 39, p. 337, pl. 44, 1911.

Occurrence.—Females found abundantly on the gills of the silversides minnow (*Menidia notata*) and the 2-spined stickleback (*Gasterosteus bispinosus*), everywhere within the present area.

Distribution.—Not reported outside of the Woods Hole area.

Color.—The adult females are a uniform milky white, the only spot of pigment being the eye, which is ruby-red; eggs also white until almost ready to hatch.

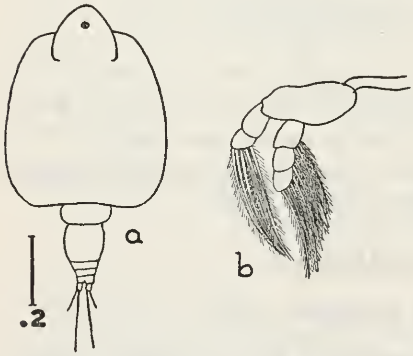

Figure 230.—*Ergasilus manicatus: a,* Female, dorsal; *b,* female, fourth leg

Female.—Head fused with first segment, the two a little longer than wide, the antennal area projecting from the center of the anterior margin; urosome one-fourth as long as metasome; genital segment barrel-shaped; caudal rami wider than long. Each of the first two segments of the second antennae prolonged into a rounded puff sleeve, enclosing the base of the next segment; terminal segment a stout claw with a blunt tooth on the inner margin near the base; fifth legs each a tiny knob tipped with one seta. Total length, 0.65–0.85 mm.

Male.—Unknown.

Remarks.—This species was first discovered by Rathbun, who made a series of drawings showing its distinctive characters; these were turned over to the present author and published in the reference given above.

ERGASILUS LABRACIS Krøyer

FIGURE 231

Ergasilus labracis KRØYER, Naturh. Tidsskrift, ser. 3, vol. 2, p. 303, pl. 11, fig. 2, 1863.—WILSON, Proc. U. S. Nat. Mus., vol. 39, p. 329, pl. 41, 1911.

Occurrence.—Found often in great abundance on the gills of the striped bass (*Roccus lineatus*) at Woods Hole.

Distribution.—Baltimore, Md. (Krøyer); Philadelphia fish markets (Leidy); Washington, D. C., fish markets (Dr. H. M. Smith); Franklin, Va. (Worth).

Color.—Mature females are milky white on the dorsal surface and opaque, young females have a bluish tinge and are more transparent; both show a variegated pattern of blue pigment dots along the center of the ventral surface on either side of the midline.

Female.—Head fused with first segment, the two more than half the entire length, projecting a little anteriorly and almost squarely truncated posteriorly; genital segment as wide as the fifth segment and as long as the abdomen and caudal rami together. Basal segment of second antenna swollen to twice the width of the second segment, apical claw with several small teeth on the inner margin near the base. Exopod of fourth leg made up of a single segment; each fifth leg lacking but replaced by a single seta. Total length, 1–1.25 mm.

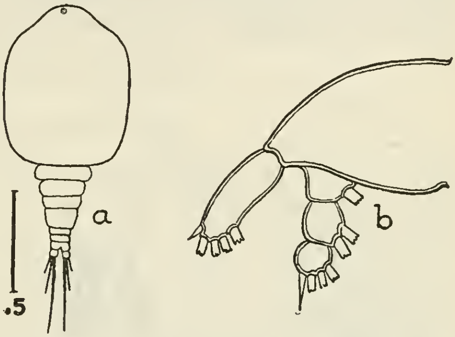

FIGURE 231.—*Ergasilus labracis*: *a*, Female, dorsal; *b*, female, fourth leg

Male.—Unknown.

Remarks.—This species is apparently confined to the striped bass, upon which it may be found in almost any fish market along the entire Atlantic coast.

ERGASILUS CENTRARCHIDARUM Wright

FIGURE 232

Ergasilus centrarchidarum WRIGHT, Proc. Can. Inst., new ser., vol. 1, p. 243, pl. 1, 1882.—WILSON, Proc. U. S. Nat. Mus., vol. 39, p. 331, pl. 42, figs. 50–58, 1911.

Occurrence.—Females were obtained from the gills of the smelt (*Osmerus mordax*), in the vicinity of Woods Hole by Vinal Edwards.

Distribution.—Lake Maxinkuckee, Lake Winona, Ind. (Wilson); Canadian lakes and ponds (Wright); Mississippi River at Fairport, Iowa, Lake Erie (Wilson).

Color.—Body a clear cartilage color, translucent in young females, opaque in adults; ovaries and oviducts opaque white. Eggs white when first extruded, but acquiring blue pigment gradually until when ready to hatch the entire ovisacs appear blue. Eye red or reddish.

Female.—Head fused with first segment, the two four-fifths of the body length and covering the rest of the metasome in dorsal view; fifth segment very short and narrow; urosome one-fourth as long as metasome; genital segment barrel-shaped; caudal rami as long as anal segment. Basal segment of second antenna swollen to twice the diameter of the second segment, the apical claw with a smooth inner margin. Exopod of fourth leg 3-segmented; each fifth leg lacking but replaced by a single seta. Total length, 0.8–0.9 mm.

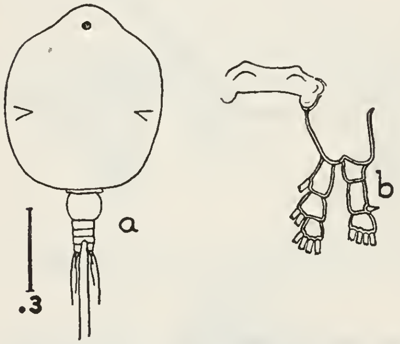

Figure 232.—*Ergasilus centrarchidarum:* *a,* Female, dorsal; *b,* female, fourth leg

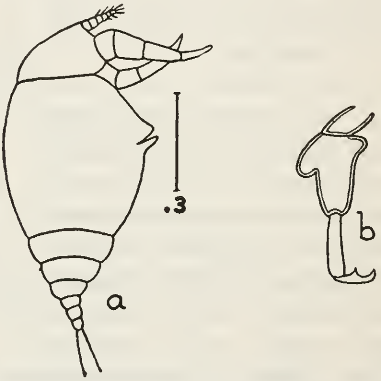

Figure 233.—*Ergasilus funduli: a,* Female, lateral (after Krøyer); *b,* female, second antenna

Male.—Unknown.

Remarks.—This is almost entirely a fresh-water species, and, as its name implies, it infests practically every species of fish belonging to the family Centrarchidae.

ERGASILUS FUNDULI Krøyer

Figure 233

Ergasilus funduli Krøyer, Naturh. Tidsskrift, ser. 3, vol. 2, p. 228, pl. 11, 1863.—Wilson, Proc. U. S. Nat. Mus., vol. 39, p. 328, 1911.

Occurrence.—Found very rarely on the common mummichog (*Fundulus heteroclitus*).

Distribution.—New Orleans, La. (Krøyer).

Color.—Unknown.

Female.—Head fused with first segment, the two two-thirds the body length, the antennal area projecting from the center of the frontal margin, and separated from the rest of the head by a well-defined groove. Urosome only one-eighth as long as metasome; genital segment oval, narrowed anteriorly; caudal rami as wide as long; apical setae very unequal. Second segment of second antenna much wider than the first, with a large lobe on the outer margin and a smaller one on the inner margin, apical claw with a tooth at the center of the inner margin. Ovisacs as long as the body, spindle-shaped. Total length, 0.7 mm.

Male.—Unknown.

Remarks.—This species is apparently confined to the mummichogs, and is not at all abundant, a long search for it resulting in a single badly mutilated specimen.

Family BOMOLOCHIDAE

Genus TUCCA Krøyer, 1837

Body made up of a small cephalothorax joined by a short neck to an inflated thoracic trunk, to which is attached posteriorly a short urosome. Cephalothorax inflated dorsally, deeply hollowed ventrally, with a lobed wing on each lateral margin. First antennae 4-segmented; second antennae 3-segmented, end segment covered with rows of short spines and tipped with curved claws. Mouth parts at the bottom of the ventral depression of the head; rami of first legs widened and 3-segmented, of the second legs 2-segmented; exopods of third and fourth legs 2-segmented, endopods 1-segmented; fifth legs lacking in the female, uniramose and 1-segmented in the male. Ovisacs cylindrical, eggs minute and exceptionally numerous.

KEY TO THE SPECIES (FEMALES)

1. Posterior margin of thoracic trunk distinctly 3-lobed, not overhanging or concealing the urosome………………… impressus (p. 379)
   Posterior margin of thoracic trunk smoothly rounded, but overhanging and entirely concealing the urosome……… corpulentus (p. 380)

TUCCA IMPRESSUS Krøyer

Figure 234

Tucca impressus Krøyer, Naturh. Tidsskrift, vol. 1, p. 479, pl. 5, fig. 2, 1837.—Wilson, Proc. U. S. Nat. Mus., vol. 39, p. 354, pls. 48–49, 1911.

Occurrence.—On the pectoral and dorsal fins of the swellfish (*Chilomycterus schoepfi*), at Woods Hole.

Distribution.—Danish West Indies on *Diodon hystrix* (Krøyer); west coast of Africa on *Diodon* (Nordmann); Beaufort, N. C., on *Chilomycterus* (Wilson).

Color.—When alive a light cartilage gray, when preserved, any color from dirty white to dark grayish brown, according to the kind of preservative used.

Female.—Cephalic segment small and hemispherical, flattened ventrally; each lateral wing wide and divided at the center into two lobes; neck short, formed of the second segment; third, fourth, and fifth segments much wider than the cephalic segment and so much inflated that the thickness nearly equals the width, with concave lateral margins and evenly rounded corners. Third and fourth legs in pits on the ventral surface of the trunk; four similar pits on the dorsal surface immediately above these ventral ones; fifth legs lacking; genital segment small, forming with the single abdominal segment a triangle; caudal rami attached to the ventral surface of the abdomen. Total length, 1.5–1.7 mm.

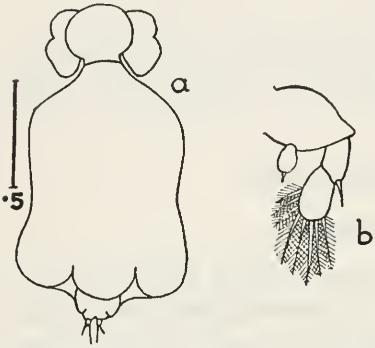

Figure 234.—*Tucca impressus: a,* Female, dorsal; *b,* female, fourth leg

Male.—Cephalic segment as wide as the trunk, its lateral wings not lobed; urosome relatively larger than in the female; trunk elliptical, with convex lateral margins; third and fourth legs larger; fifth legs present on the posterior margin of the trunk, each 1-segmented with three apical setae. Genital segment half the width of the trunk, with a stout hook on the ventral surface at each posterior corner; caudal rami longer than in the female. Total length, 1.2–1.3 mm.

Remarks.—This is a fairly common parasite on the southern puffer, and is always found on the fins; it can be recognized by the four pits on the dorsal and ventral surfaces and the three lobes at the posterior end of the trunk in the female.

TUCCA CORPULENTUS Wilson

Figure 235

Tucca corpulentus Wilson, Proc. U. S. Nat. Mus., vol. 39, p. 358, pls. 49, 50, 1911.

Occurrence.—Found upon the fins of the northern puffer (*Sphoeroides maculatus*) captured off Marthas Vineyard.

Distribution.—Found only in the present area.

Color.—The preserved specimens were a uniform gray.

Female.—Cephalic segment with its wings divided into four lobes instead of two; trunk swollen almost into a sphere, as wide as long, with no pits on dorsal or ventral surfaces; posterior margin without lobes but overhanging the urosome and completely hiding it in dorsal view. Second segment of mandibles with a large spine on its posterior margin near the distal end; apical claw of maxillipeds transversely corrugated. Total length, 2–2.3 mm.

Male.—Unknown.

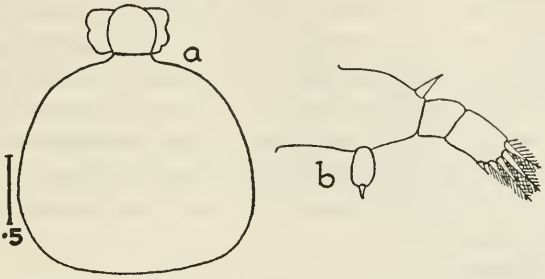

FIGURE 235.—*Tucca corpulentus: a,* Female, dorsal; *b,* female, fourth leg

Remarks.—This can be distinguished from the preceding species by its larger size, by the fact that the trunk conceals the urosome in dorsal view, and by the absence of pits on dorsal and ventral surfaces.

Genus BOMOLOCHUS Nordmann, 1832

Body cyclopoid; head fused with first segment and enlarged, the rest of the metasome tapered regularly backward; urosome 4-segmented in both sexes; genital segment enlarged but little, lobed at posterior corners in the male; caudal rami short and wide. First antennae 6-segmented, the three basal segments fused in the female, widened, and fringed with a row of flattened setae; second antennae 4-segmented; maxillipeds in female turned forward outside the other mouth parts and more or less fused with the head, the apical claw S-shaped, in the male normally placed. Endopod of first leg 3-segmented, exopod 1-, 2-, or 3-segmented; endopods of second, third, and fourth legs 3-segmented, exopods 3- or 4-segmented; fifth legs uniramose, 2- or 3-segmented. Both sexes parasitic on gills of fishes in fresh or salt water.

KEY TO THE SPECIES (FEMALES)

1. Exopods of second, third, and fourth legs 4-segmented; both rami of first legs 2-segmented; fifth leg 2-segmented-------- teres (p. 381)
   Exopods of second, third, and fourth legs 3-segmented; both rami of first legs 3-segmented; fifth leg 3-segmented.
   albidus, new species (p. 382)

BOMOLOCHUS TERES Wilson

PLATE 23, *a, b*

Bomolochus teres WILSON, Proc. U. S. Nat. Mus., vol. 39, p. 379, pl. 59, 1911.

Occurrence.—Many females from the gills of the common menhaden (*Brevoortia tyrannus*) at Woods Hole.

Distribution.—Not found outside the present area.

Color.—Dorsal surface light brown, often with a greenish tinge, ventral surface paler and yellow.

Female.—Cephalic segment semielliptical, one-half wider than long; bases of first antennae wholly visible in dorsal view; metasome regularly tapered; posterior margin of fourth segment only half the width of anterior margin; urosome two-thirds as long as metasome; caudal rami narrow cylindrical, twice as long as wide. Exopods of second, third, and fourth legs 4-segmented, their outer spines dentate and flagellate; fifth leg 2-segmented, end segment four times as long as wide, with one outer and three unequal apical setae. Total length, 2–2.15 mm.

Male.—Unknown.

Remarks.—This is a rare species, which may be recognized by the 4-segmented exopods of the second, third, and fourth legs.

BOMOLOCHUS ALBIDUS, new species

PLATE 23, *c–j*

Occurrence.—Found abundantly in the gill chambers of nearly every goosefish (*Lophius piscatorius*) examined at Woods Hole. They are fastened to the skin in the little pocket above each pelvic fin, but do not appear elsewhere. A single female (U.S.N.M. No. 60589) is made the species holotype; the others become paratypes with U.S.N.M. No. 60590.

Color.—Body white and opaque, without pigment; eggs also white; no eye visible.

Female.—Cephalic segment strongly arched dorsally and transversely elliptical, three-fifths as long as wide; basal half of first antennae entirely concealed in dorsal view. Second and third metasome segments about the same width, which is a little narrower than the head; fourth segment abruptly reduced to half the width of the third; fifth segment considerably widened at the center through the bases of the fifth legs and about as wide as the fourth segment. Urosome about half the length of the metasome; genital segment widest at the center and nearly as wide as long. The three abdominal segments the same width and length, with convex lateral margins; caudal rami half the length of the anal segment, narrowed posteriorly, close together and parallel with each other. The inner terminal seta is the longest and is about equal in length to the urosome. Ovisacs slender and cylindrical, with bluntly rounded ends, and nearly twice the length of the urosome.

First antennae long and slender, basal portion not much enlarged and bent at almost an exact right angle. Third segment of second antenna considerably enlarged but not so long as the basal segment;

its surface is roughened by the usual rows of spines, and from near the outer distal corner projects a peculiar foot-shaped process, with a prominent heel and two stout setae for toes. The distal segment terminates in five curved claws of varying lengths and a large rounded process covered with spines.

The mandibles are slender, turned back beneath the upper lip, and tipped with a short and slender spine, minutely denticulate along each lateral margin. The three setae of each first maxilla vary greatly in size, the inner one being three times the length of the outer, while the middle one is halfway between the other two. The basal segment of the second maxilla is stout and inclined backward; the second segment is comparatively small and is terminated by two blunt spines, about the same length and minutely denticulate along their anterior margin. The maxillipeds have a slender basal segment, carrying on its inner margin a short and blunt papilla, tipped with a tuft of short cilia. The terminal claw is very long and slender and is bent into the shape of the letter S, with a short and weak plumose seta on the ventral surface at the base.

The first legs are moderately widened, each ramus 3-segmented, its terminal segment armed with five flattened plumose setae. The three following pairs of legs have 3-segmented rami, the endopods of the third and fourth pairs quite slender, with elongate terminal segments. The fifth legs are uniramose and 3-segmented, the terminal segment longer than the two basal segments combined, and armed distally with four unequal nonplumose setae. Total length, 1.8–2.1 mm.

Male.—Unknown.

Remarks.—This species can be identified by the enlarged third segment of the second antenna, with its foot-shaped process, and by the papilla on the inner margin of the basal segment of the maxillipeds. When alive these copepods are very active and move about over the inner surface of the pocket with ease and rapidity. They are easy to find since their white color stands out in contrast to that of the fish's skin. Extensive search has failed to reveal a single male.

Genus ARTACOLAX Wilson, 1908

Head fused with the first segment and much wider than long; second segment free, third and fourth segments fused and overlapping the fifth segment dorsally; fifth segment free and abruptly narrowed to half the width of the fused third and fourth segments, or less. Urosome 4-segmented in the female, 3-segmented in the only known male; genital segment enlarged but little; caudal rami short. First antennae 6-segmented; second antennae 3-segmented, with stout apical claws; maxillipeds turned forward outside the other mouth parts. First legs with 1-segmented exopod and 2- or 3-segmented endopod; rami of three following pairs of legs 3-segmented; fifth legs uniramose, 2-segmented. A single species.

ARTACOLAX SAETIGER Wilson

FIGURE 236

Artacolax saetiger WILSON, Proc. U. S. Nat. Mus., vol. 39, p. 361, pl. 51, 1911.

Occurrence.—Found on the gills of the flying fish (*Exocoetus volitans*) taken at Woods Hole.

Disribution.—Not found outside the present area.

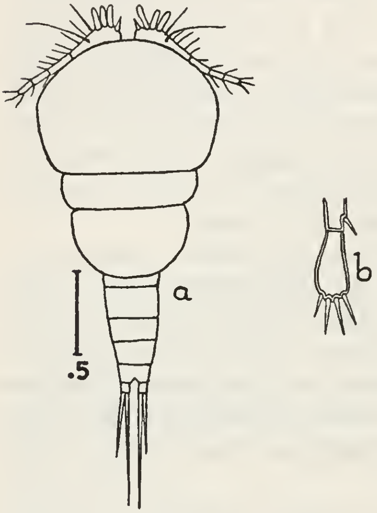

FIGURE 236.—*Artacolax saetiger: a,* Female, dorsal; *b,* female, fifth leg

Color.—Body a rich seal brown, uniform over the entire dorsal surface, paler and somewhat yellowish on the ventral surface; eye invisible; eggs white.

Female.—Cephalic segment semielliptical, posterior margin straight, anterior margin unevenly rounded, length to width as 7:10; third and fourth segments also semielliptical, much narrower than the cephalic segment, length to width as 2:3. Sides of genital segment straight; abdomen considerably narrowed posteriorly; caudal rami quadrangular, as wide as long. Each first antenna armed at its base with a chitin plate split into three finger-like processes; apical claw of maxillipeds armed with two huge plumose setae; terminal segment of fifth leg twice as long as basal segment and armed with four apical setae. Total length, 2 mm.

Male.—Unknown.

Remarks.—This species can be recognized by the tripartite chitin plate projecting from the frontal margin of the base of each first antenna. Only a few flying fishes have been examined for this parasite, and it may be more common than would be inferred from the above account.

Family TAENIACANTHIDAE

Genus ANCHISTROTOS Brian, 1906

Body cyclopoid; head fused with the first segment, much larger than any of the free segments, with a small rostral projection at the center of the frontal margin. Urosome one-third the length of the metasome, 5-segmented in the female; genital segment enlarged but little; abdomen tapered considerably; caudal rami short, narrow, divergent. First antennae 6-segmented; second antennae 3-segmented, with large terminal claws; maxillipeds in normal position behind the other mouth parts. Rami of first legs 1-segmented, of the three following pairs 3-segmented; fifth legs uniramose, 1-segmented. A single species.

ANCHISTROTOS OCCIDENTALIS Wilson

FIGURE 237

Anchistrotos occidentalis WILSON, Proc. U. S. Nat. Mus., vol. 64, art. 17, p. 6, pl. 2, figs. 10–18, 1924.

Occurrence.—Taken from the gills of the orange file fish (*Alutera schoepfii*) at Woods Hole.

Distribution.—Not found outside the present area.

Color.—Body a uniform yellowish white, becoming tinged with brown in preservatives; eye invisible; eggs white.

Female. — Cephalic segment strongly arched dorsally and reentrant ventrally; fifth segment widened through the bases of the fifth legs and considerably wider than the genital segment. Of the four abdominal segments the basal one is the longest and the third one is the shortest; the caudal rami are widely separated and divergent, each with two unequal apical setae. The corrugated area forms a fingerlike process on the outer margin of the end segment of the second antenna; the terminal claw of the maxillipeds is long, slender, and sickle-shaped; the fifth legs are spatulate, with four apical setae. Total length, 1.75 mm.

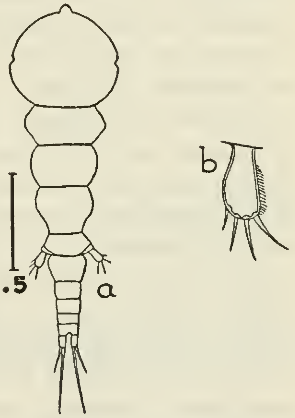

FIGURE 237.—*Anchistrotos occidentalis: a,* Female, dorsal; *b,* female, fifth leg

Male.—Unknown.

Remarks.—This parasite, like its host, is evidently a straggler from farther south, and will only be found in very limited numbers.

Suborder NOTODELPHYOIDA

Fifth thoracic segment forming in the male a movable articulation with the fourth, but firmly attached to the sixth. In the female there is usually no movable articulation, the segments of both metasome and urosome in this region being rigidly fused and supporting on their dorsal surface an incubatory pouch. The exceptional females that bear normal ovisacs are articulated like the males. Urosome cylindrical and considerably narrower than the metasome; eggs usually received into an incubatory pouch and not carried in external ovisacs. First antennae short, made up of few segments, both of them prehensile in the male; second antennae without an exopod and distinctly prehensile, with one or more apical claws. First four pairs of legs usually biramose, sometimes uniramose, one or more pairs often lacking; fifth legs uniramose, 1- or 2-segmented. Living either as commensals within the body of ascidians and other invertebrates, or as parasites upon their outer surface.

Remarks.—Every genus belonging to this group is either parasitic or commensal, and at least 80 per cent of them live within ascidians. As a result of this mode of life most of them are profoundly modified in body form and in the structure of the various appendages. This modification, however, has not been carried far enough to destroy the systematic value of the appendages, and they still afford the best means of identification. But it has resulted in a marked sexual dimorphism; the great majority of the males retain throughout life the ability to swim about freely, while the females on reaching maturity become confined to the body of their host. The male accordingly retains most of the characteristics of free swimmers, and the female loses them to a greater or less degree. Consequently the sexes must be separated in the key (Appendix B, p. 598) with but few exceptions, and in more than half of the genera the male unfortunately still remains unknown.

During the years from 1864 to 1880 Hesse established many new genera among these ascidian commensals, but both his descriptions and the accompanying figures were so inaccurate and contradictory as to possess almost no systematic value. Many of his genera become mere historical curiosities, as Chatton and Brement have well pointed out, but the fact still remains that if any of them become capable of recognition, as has already happened in many instances, they must retain the names he gave them. For this reason alone, and not because they are regarded as being at present valid, they are located exactly according to the characters he gave them.

Family NOTODELPHYIDAE

Genus NOTODELPHYS Allman, 1847

Head fused with first segment, second and third segments free and separated by deep lateral sinuses; fourth and fifth segments fused, dilated laterally and strongly arched dorsally to form brood pouch. Urosome narrow cylindrical, 5-segmented; genital segment not enlarged in female but swollen in male; caudal rami much longer than wide, ciliated on both lateral margins. First antennae 15-segmented;

second antennae 3-segmented, prehensile; rami of first four pairs of legs 3-segmented; fifth legs uniramose, 2-segmented. A single species in the present area.

NOTODELPHYS AGILIS Thorell

FIGURE 238

Notodelphys agilis THORELL, Kongl. Vet. Akad. Handl., vol. 3, no. 8, p. 40, pls. 4, 5, 1859.—SARS, Crustacea of Norway, vol. 8, p. 35, pl. 17, fig. 3, 1921.

Occurrence.—Three females from *Ascidia parallelogramma* at Woods Hole, 1925.

Distribution.—Coast of Bohuslän (Thorell); British Isles (Brady); coast of France (Canu); Bay of Fundy (U. S. National Museum).

Color.—Body transparent with a whitish tinge, the ripe ova dark reddish brown; eye ruby-red.

Female.—Incubatory pouch oval in dorsal outline, widened posteriorly; caudal rami almost five times as long as wide, the outer seta attached to a small protuberance at the center of the outer margin. Proximal segment of fifth legs broad and smooth, without cilia, its outer margin bearing a digitiform process tipped with a filiform seta. Distal segment not constricted at its base, irregularly pentagonal, with a slender apical seta and a shorter one at the inner distal corner. Total length, 3.4–3.6 mm.

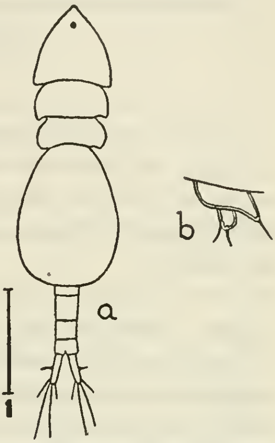

FIGURE 238.—*Notodelphys agilis:* *a*, Female, dorsal (after Sars); *b*, female, fifth leg

Male.—Unknown.

Remarks.—This species is most easily distinguished by the form and armature of the caudal rami, the outer seta being almost at the center of the outer margin. The inner margin of these rami is often destitute of the usual cilia, which is exceptional for the genus.

Family DOROPYGIDAE

Genus DOROPYGUS Thorell, 1859

Body in the female distinctly compressed laterally and curved ventrally, in the male cylindrical and tapered posteriorly; head and first three thoracic segments distinctly separated; fourth and fifth segments fused into a huge incubatory pouch, produced gibbously backward, overlapping the genital segment. The caudal rami are elongate, narrowed, and sometimes coiled distally. First antennae 8- or 9-segmented, the two basal segments very broad; second antennae 3-segmented, prehensile; rami of first four pairs of legs 3-segmented, the two terminal segments of the third endopod sometimes fused; fifth legs uniramose, 2-segmented.

KEY TO THE SPECIES (FEMALES)

1. Urosome nearly in line with metasome; second antenna wide and flattened, its second segment as wide as long. **laticornis**, new species (p. 388)
   Urosome at right angles to metasome; second antenna narrow and cylindrical, its second segment twice as long as wide--- **pulex** (p. 389)

DOROPYGUS LATICORNIS, new species

Plates 1, *c;* 24

Occurrence.—Both sexes were taken from the branchial cavity of *Molgula manhattensis* at Woods Hole, July, 1924. One of the females is made the holotype of the new species with U.S.N.M. No. 56570; the other females and a male become paratypes, with U.S.N.M. No. 56571.

Color.—Body yellowish white, the ova in the incubatory pouch dark yellow; eye dark ruby-red.

Female.—Head turned downward, the sides of the carapace overlapping the first segment and reaching the second segment; the first thoracic segment the shortest, the second and third segments increasing in length; the incubatory pouch not much inflated dorsally and broadly rounded posteriorly, produced backward on the dorsal surface of the genital segment beyond the center of the latter; eggs rather large and few in number. Urosome slender, 4-segmented, the genital segment longer than any of the abdominal segments, but no wider; the three abdominal segments about the same length, but tapered in width; anal segment notched at the center of its posterior margin. Caudal rami slender, nearly twice the length of the anal segment, five times as long as their basal width, each with two minute spines at its tip, the lateral margins smooth.

First antennae 9-segmented, the two basal segments twice as wide as long, the next four segments tapering regularly, the last three segments about the same width, all except the first basal segment heavily armed with setae. Second antennae much widened and flattened, the basal segment enlarged at its distal end, with a rounded knob bearing a short spine on the inner corner. The second segment is a little wider than long, the inner margin strongly convex at the proximal end. Between this convexity and the one on the distal end of the basal segment is a deep triangular notch, which stands out conspicuously when examining the antenna. The end segment is two and a half times as long as wide and is tipped with a stout curved claw and a seta.

In the second legs the two terminal segments of the endopod are fused with no trace of a groove between them, but with a transverse row of spinules where the groove should be, similar to those along the distal margins of the other segments in both rami. These two second-leg rami are about equal in length, the endopod with four apical, one outer, and five inner setae, the exopod with two apical, six outer, and five inner setae.

In the fifth leg the basal segment is one-half wider than the terminal and carries at the center of its inner margin a short filiform seta thickened at its base. The distal segment is four times as long as wide, slightly narrowed distally, with four small denticles on the outside margin near the tip. The end is obliquely truncated, with a short spine at the outer corner and a long curved seta at the inner corner. Total length, 2–2.5 mm.

Male.—Body slender and cylindrical, but curved ventrally like that of the female; head separated from the first segment, wider than long, with rounded lobes at the posterior corners. First thoracic segment very short and only two-thirds as wide as the head; second, third, and fourth segments about the same length, which is twice that of the first segment, and tapering regularly backward; fifth segment the same length as the first and narrower than the fourth.

Urosome 5-segmented, tapered regularly backward; anal segment with a small notch at the center of the posterior margin; caudal rami as long as the last two segments combined, slender, slightly curved like parenthesis marks, each with two minute apical spines. Antennae, mouth parts, and swimming legs similar to those of the female. Total length, 0.75 mm.

Remarks.—This species can be most easily recognized by the structure of the second antennae and the fifth legs. The ascidian that serves as its host is fairly abundant around Woods Hole, and there is every reason to believe that further examination would reveal not only this but also other commensals. This is one of the directions in which the search for copepods within the present area has been comparatively quite limited; hence the prospects for further efforts are exceptionally good.

DOROPYGUS PULEX Thorell

FIGURE 239

Doropygus pulex THORELL, Kongl. Vet. Akad. Handl., vol. 3, no. 8, p. 46, pl. 6, 1859.

Occurrence.—Two females were obtained from a *Molgula papillosa* Verrill, dredged in 6 fathoms off Marthas Vineyard on a stony bottom.

Distribution.—Mediterranean (Brian, Buchholz); coast of France (Canu, Hesse); Bohuslän (Aurivillius); British seas (T. Scott); Arctic Ocean (Thorell).

Color.—Body opaque and brownish white; digestive tract reddish yellow; ova dark green; eye ruby red.

Female.—Body strongly compressed, highly arched dorsally; fourth and fifth segments raised but little above the third segment, but carried backward far behind the genital segment. Sometimes the posterior end is turned downward and forward pushing the urosome forward until its tip falls beneath the head. Urosome only a third or a fourth as long as the metasome, and usually turned down at right angles to the latter. First antennae 10-segmented, the second segment enlarged and densely setose, the last four segments turned forward; second antenna cylindrical, its second segment twice as long as wide. Basal segment of fifth leg wider and three-fourths as long as the terminal segment, without a seta on its inner margin. Terminal segment three times as long as wide, with four small spines on the outer margin near the distal end; the tip is rounded, without the long filiform seta at the outer corner and the short spine inside of it. Total length, 3–4 mm.

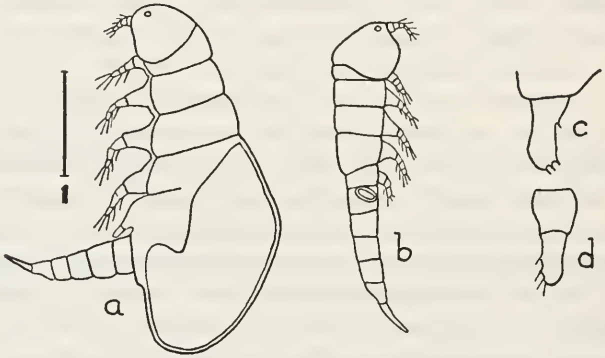

Figure 239.—*Doropygus pulex: a,* Female, lateral (after Thorell); *b,* male, lateral; *c,* male, fifth leg; *d,* female, fifth leg

Male.—Body slender, the body axis nearly straight and not curved ventrally; first and fifth segments very short; second segment twice the length of the first; third and fourth segments twice the length of the second. Urosome 5-segmented, the first and second abdominal segments the same length, each longer than the genital segment and also longer than either of the last two segments. Anal segment very short; caudal rami rather stout, as long as the last two segments combined, each with two minute apical spines. Total length, 1.45–1.6 mm.

Remarks.—This species has been found in several different hosts. It seems to develop a larger size in the Mediterranean than in the colder oceans. The fact that the urosome is always turned at least at right angles to the metasome, and sometimes even inclined forward, is sufficient to distinguish this from the preceding species.

Family BOTRYLLOPHILIDAE

Genus BLAKEANUS Wilson, 1921

Head and first four segments of metasome completely fused and strongly vaulted dorsally; antennae, mouth parts, and four pairs of swimming legs packed closely together in a long groove on the ventral surface, surrounded by a raised lip or margin; fifth segment abruptly narrowed and depressed; fifth legs hornlike, on the sides of the segment. Urosome shorter than metasome, 5-segmented; two ovisacs attached to dorsal surface of genital segment; caudal rami flattened laterally and curved dorsally. First antennae 4-segmented; second antennae 3-segmented; rami of first three pairs of legs, and the exopod of the fourth pair 3-segmented; fourth endopod 2-segmented. A single species in the area.

BLAKEANUS CORNIGER Wilson

FIGURE 240

Blakeanus corniger WILSON, Proc. U. S. Nat. Mus., vol. 59, p. 11, pl. 5, 1921.

Occurrence.—A single adult female with ovisacs was taken from the ascidian *Cynthia carnea* Verrill, in Long Island Sound in 1874.

Color.—Body of the preserved specimen brownish yellow, ovisacs darker than the body; no eye visible.

Female.—Dorsal inflation of metasome greatest in the fourth segment, where the height is about equal to the length and breadth of the entire inflation. Genital segment cylindrical, wider than long; first, third, and fourth abdominal segments the same length, second segment longer. Basal segment of first antenna enlarged into a sort of hand with seven fingers, each tipped with a stout seta; remaining three segments of the antenna attached like a thumb on the outer margin of the hand. Basal segment of second antenna very short, the other two segments much longer and about equal. Total length, 4 mm.

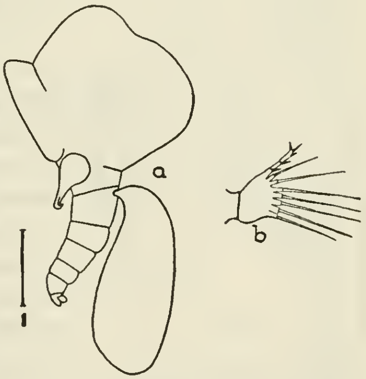

FIGURE 240.—*Blakeanus corniger: a,* Female, lateral; *b,* female, first antenna

Male.—Unknown.

Remarks.—Hansen has reported a second species of the genus from *Cynthia rustica* in Greenland. The highly vaulted and unsegmented metasome and the 5-segmented urosome are distinctive characters.

Genus BOTRYLLOPHILUS Hesse, 1864

Metasome in female sharply marked off from urosome, its segments more or less completely fused and carrying at the posterior end, on the dorso-lateral surface, the migrant fifth legs. Urosome narrow cylindrical, 4-segmented; genital segment not enlarged. First antennae 4-segmented; second antennae 3-segmented, prehensile; rami of first four pairs of legs 1- or 2-segmented, the exopods with spines, the endopods with setae; fifth legs in female narrow, setiferous processes extending backward from the dorso-lateral surface of the fifth segment on each side of the adherent ovisacs; in the male not dorsally migrant, 1-or 2-segmented; first four exopods in male 3-segmented, first endopod 1- or 2-segmented, the other three endopods 2- or 3-segmented. A single species in this area.

BOTRYLLOPHILUS BREVIPES Sars

FIGURE 241

Botryllophilus brevipes SARS, Crustacea of Norway, vol. 8, p. 68, pl. 32, 1921.

Occurrence.—Several females were obtained from the branchial sac of the ascidian *Phallusia obliqua* at Station 237, *Fish Hawk.*

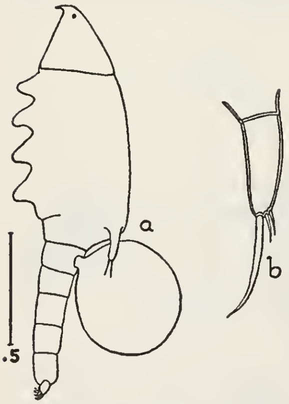

FIGURE 241.—*Botryllophilus brevipes: a,* Female, lateral; *b,* female, fifth leg

Distribution.—In ascidians on the coast of Norway (Sars).

Color.—Body pale reddish orange, the ovaries, oviducts, and ripe ova bright green; eye dark red.

Female.—Body short and stout; metasome segments completely fused, vaulted dorsally and abruptly rounded posteriorly; urosome more than half the length of the metasome, 4-segmented, straight; genital segment divided, the anterior portion swollen; anal segment longer than the one preceding it; caudal rami curved outward, each tipped with four stout claws. First antennae 4-segmented, very broad at the base, but rapidly tapered distally; second antennae 3-segmented, middle segment very short. Rami of first four pairs of legs 1-segmented; setae on endopods enlarged at base and slender distally; fifth leg a narrow conical process, with one long and two short apical setae. Total length, 1.5–1.75 mm.

Male.—Unknown.

Remarks.—This species may be distinguished by the complete fusion of the metasome segments and by the reduced segmentation in the first four pairs of legs.

Suborder MONSTRILLOIDA

Posterior antennae and mouth parts entirely lacking in the adults of both sexes; only the merest trace of an alimentary canal, incapable of functioning. The fully developed copepod is thus unable to feed and must subsist upon nourishment accumulated during its juvenile parasitic existence; the sexually mature stage is devoted wholly to reproduction. The group is divided into two families, which differ radically in their characters.

Family Monstrillidae.—Fifth thoracic segment forming a movable articulation with the fourth, but firmly attached to the sixth (genital), segment; body elongate, urosome considerably narrower than the metasome, both cylindrical. Eggs not carried in ovisacs or brood pouches, but glued to a pair of slender filaments issuing from the ventral surface of the genital segment. In the male these filaments are replaced by a single clavate appendage, within which the spermatophores are carried before extrusion. First antennae extending straight forward in line with the body axis and parallel with each other. Parasitic during the larval stages, free swimming and pelagic in the adult stage.

Family Thespesiopsyllidae.—Fourth thoracic segment forming a movable articulation with the third, but firmly attached to the fifth segment; anterior body much wider than the posterior and somewhat flattened. Eggs carried in two ovisacs attached to the sides of the genital segment. First antennae extending outward at right angles to the body axis; the first three pairs of legs biramose, rami 3-segmented; fourth and fifth pairs uniramose, 3-segmented. Free swimming and pelagic in the adult stage, the larval stages as yet unknown.

Family MONSTRILLIDAE

Genus MONSTRILLA Dana, 1848

Head fused with the first segment and in the female half the entire body length or more, shorter in the male; free segments and urosome tapered regularly, with rounded lateral margins. Urosome 3-segmented in female, 4-segmented in male; caudal rami lamellar, each with five or six setae. First antennae elongate and obscurely segmented; basipods of legs very large and flattened; rami short, exopod longer than endopod, with only two outer spines; fifth legs lamellar in female and 1-segmented, with three or four marginal setae, in the male reduced to a mere knob tipped with two setae or lacking.

KEY TO THE SPECIES (BOTH SEXES)

1. Terminal segment of first antennae with 5 small spines or denticles on inner margin at distal end ------------------ serricornis (p. 242)
   Terminal segment of first antennae covered dorsally at tip with transverse rows of comblike teeth ------------------------ anglica (p. 242)

MONSTRILLA SERRICORNIS G. O. Sars

Figure 242

Monstrilla serricornis Sars, Crustacea of Norway, vol. 8, p. 19, pl. 10, 1921

Occurrence.—Taken in surface tow at Stations 20046, 20056, 20058, 20061, *Grampus*, in the Gulf of Maine in March and April, 1920.

Distribution.—Coast of Norway (Sars); Gulf of Maine (Bigelow).

Color.—Body transparent anteriorly but tinged with yellow posteriorly.

Male.—Body short and stout and somewhat club-shaped in lateral view; cephalic segment a little longer than the rest of the metasome, its lateral margins nearly parallel, its ventral surface prominent anteriorly, but without an oral tubule. Urosome 4-segmented; genital segment with a subclavate copulative organ on its ventral surface; caudal rami small and divergent, each with five nearly equal setae. First antennae two-thirds as long as the cephalic segment, 5-segmented, the end segment with five small teeth on its inner margin at the tip; fifth legs lacking. Total length, 1.75 mm.

Female.—Unknown.

Remarks.—The four stations of the *Grampus* named above are so widely scattered that they indicate that the species is likely to be found anywhere in the pelagic portion of the present area. It is also evidently very rare and can be regarded only as a straggler from the open ocean. Sars established this species upon two males taken on the coast of Norway, and all the specimens obtained here on the American coast have also been males.

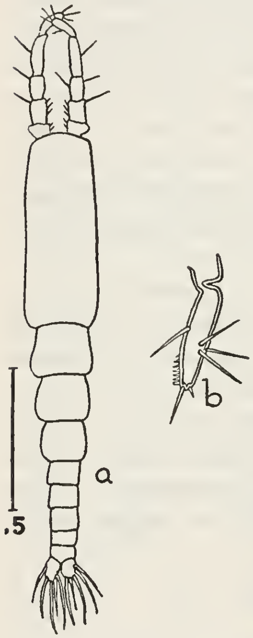

Figure 242.—*Monstrilla serricornis*: *a*, Male, dorsal (after Sars); *b*, male, end segment of first antenna

MONSTRILLA ANGLICA Lubbock

Figure 243

Monstrilla anglica Lubbock, Ann. Mag. Nat. Hist., ser. 2, vol. 20, p. 404, pl. 10, 1857.—Bourne, Quart. Journ. Micr. Sci., new ser., vol. 30, pt. 4, p. 576, pl. 37, 1890.

Occurrence.—Two males were obtained in a surface tow at Station 20056, *Grampus*, in the Gulf of Maine, March, 1920.

Distribution.—British seas (Lubbock, Brady, Thompson, Bourne).

Color.—Body reddish brown, deepest in the male in the genital segment and the bases of the swimming legs.

Female.—Body elongate; cephalic segment a half longer than the rest of the thorax, with nearly parallel lateral margins; free segments and urosome tapered regularly backward; genital segment twice as long as first abdominal segment, and the latter is a half longer than the anal segment; caudal rami longer than wide, parallel, narrowed distally, each with five marginal setae and one dorsal. First antennae three-fourths as long as the cephalic segment, indistinctly segmented; fifth legs subcylindrical, twice as long as wide, narrowed distally and fringed on the inner margin with cilia, each with two long apical setae. Total length, 3.2 mm.

Male.—Body elongate; cephalic segment little more than half the length of the rest of the body; second, third, and fourth segments regularly tapered backward; fifth segment abruptly narrowed to half the width of the fourth segment. Urosome 4-segmented, the same width as the fifth segment; genital segment and first two abdominal segments the same length, anal segment less than half as long. Terminal segment of first antennae tipped with a series of peculiar comblike structures extending diagonally across the dorsal surface. Total length, 1.4–2 mm.

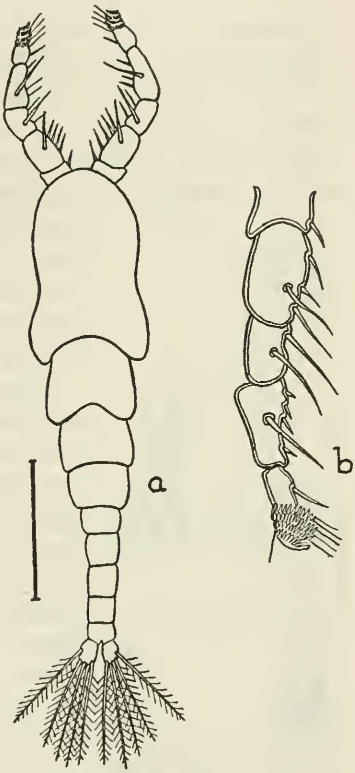

FIGURE 243.—*Monstrilla anglica: a,* Male, dorsal (after A. Scott); *b,* male, first antenna

Remarks.—The female of this species may be recognized by the shape and armature of the fifth legs, the male by the peculiar comblike armature of the first antennae. This is the first record of the species outside of the British seas.

Genus CYMBASOMA Thompson, 1888

Body elongate and cylindrical; head fused with the first segment and about half the entire body length; urosome 2-segmented in female, 3-segmented in male; caudal rami short and club-shaped.

Two and often three eye lenses visible near the anterior margin of the head; first antennae 4-segmented in female, 5-segmented in male; rami of first three pairs of legs and exopod of fourth pair 3-segmented, endopod of fourth pair 2-segmented; fifth legs short in female, with an inner lobe and three apical setae, wholly lacking in the male.

CYMBASOMA RIGIDUM Thompson

Figure 244

Cymbasoma rigidum Thompson, Journ. Linn. Soc. London, vol. 20, p. 154, pl. 13, 1888.—Sars, Crustacea of Norway, vol. 8, p. 21, pls. 10, 11, 1921.

Occurrence.—Reported by Fish as one of the summer forms at Woods Hole blown in from the Gulf Stream during heavy storms.

Distribution.—Atlantic, near Teneriffe (Thompson); Mediterranean (Giesbrecht); French coast (Claparéde); British seas (Thompson, T. Scott); coast of Norway (Sars); North Sea (Timm); Woods Hole (Fish).

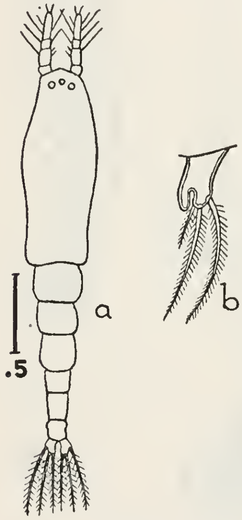

Figure 244.—*Cymbasoma rigidum*: *a*, Female, dorsal; *b*, female, fifth leg

Color.—Body very transparent anteriorly, but posteriorly yellowish gray, irregularly tinged with dark brown.

Female.—Cephalic segment dilated at the midline, with convex lateral and ventral margins; three distinct optical lenses visible near the frontal margin; free thoracic segments tapered regularly backward. Urosome less than one-sixth as long as metasome, 2-segmented, the anal segment notched laterally; caudal rami longer than wide, divergent, each armed with three setae. First antennae scarcely one-third as long as cephalic segment, 4-segmented, the end segment nearly as long as the other three combined. Fifth legs a little longer than wide, the inner terminal seta much shorter than the other two, which are about equal, the inner margin produced into a narrow tongue-shaped lobe curved outward. Ova attached to the genital filaments very numerous. Total length, 2.2–2.5 mm.

Male.—Smaller and stouter than the female; urosome 3-segmented, the anal segment notched laterally as in the female; copulative appendage on the genital segment ending in two large divergent lobes which are sausage-shaped; each caudal ramus with four subequal setae. First antennae longer than in the female, the last segment hinged and terminating in a slender spine; fifth legs entirely lacking. Total length, 1.5–1.75 mm.

Remarks.—This species may be distinguished by the three eye lenses near the frontal margin of the head, and by the 2-segmented urosome. It was recorded by Fish under the name *Thaumaleus claparedii* Giesbrecht, which is a synonym of the present species. It is another tropical visitor from the south and gets into the present area by way of the Gulf Stream.

Suborder CALIGOIDA

Fourth thoracic segment usually forming a movable articulation with the third segment, but firmly attached to the fifth. In some of the fixed parasites, however, the whole body becomes rigid in the female and the movable articulation is lost. Urosome sometimes shorter and narrower than the metasome, sometimes longer and wider, both divisions depressed.

First antennae reduced to one or two segments; second antennae prehensile, armed with claws; maxillary palp in the form of a prehensile claw, removed from the maxilla toward the margin of the carapace, behind the second antenna; maxillipeds the chief organs of prehension, often considerably swollen and the terminal claw replaced by a sort of forceps. Between the basal segments of the maxillipeds is the furca, or sternal fork, a structure peculiar to the Caligoida. Swimming legs usually more or less modified, such modification consisting of loss of swimming setae, fusion and reduction of the segments, loss of the entire endopod, making the leg uniramose, and often the disappearance of one or more pairs of legs.

Two ovisacs, each with a single row of strongly flattened eggs like a roll of coins, except a few genera among the Lernaeidae, in which the ovisacs are baglike and the eggs multiseriate. Both sexes parasitic on fishes, aquatic mammals, and rarely invertebrates; the males and less frequently the females sometimes leave their host and swim about freely in the plankton.

Remarks.—This and the following group are made up entirely ot parasites, and every genus exhibits some modification of normal structure as a result of parasitism. Comparatively few of the present group, however, become fixed to their host with sufficient rigidity to prevent moving about at will, and most of them retain their ability to swim about freely. They thus become a menace to food fishes and fish development by being able to concentrate upon a host that becomes in any way weakened.

Family CALIGIDAE

Genus CALIGUS Müller, 1785

Head fused with first three thoracic segments, fourth segment free, without dorsal plates; genital segment also without dorsal plates; abdomen 1- to 4-segmented. Frontal plates with lunules; first and second antennae 2-segmented; maxillae simple spines; first and fourth legs uniramose, second and third legs biramose, the basipods of the latter broadly laminate and fused into a transverse apron reaching nearly across the carapace. Rudiments of a fifth and sometimes a sixth pair of legs on the lateral margins or at the posterior corners of the fused fifth–genital segment. Egg strings often longer than the entire body.

KEY TO THE SPECIES

FEMALES

1. Carapace distinctly more than half the entire length ---- 2
   Carapace about half the entire length ---- 6
   Carapace distinctly less than half the entire length ---- 8
2. Abdomen, without the caudal rami, less than half as long as genital segment, with parallel sides ---- 3
   Abdomen, without the caudal rami, more than half as long as genital segment, with convex sides ---- 4
3. Genital segment longer than wide; basal segment of fourth legs with a stout plumose seta ---- **curtus** (p. 399)
   Genital segment as wide as long; basal segment of fourth legs without a plumose seta ---- **balistae** (p. 400)
4. Abdomen tapered, distal end half as wide as base; caudal rami turned inward, meeting at their tip ---- **rufus** (p. 401)
   Abdomen as wide at tip as at base, or wider; caudal rami widely separated ---- 5
5. Genital segment widest at center, with posterior lobes; claws on first legs bipartite ---- **schistonyx** (p. 401)
   Genital segment widest near posterior end, without lobes; claws on first legs simple ---- **rufimaculatus** (p. 402)
6. Genital segment wider than long; abdomen 1-segmented; dorsal surface with irregular pigment spots ---- **rapax** (p. 403)
   Genital segment as long as wide or longer; no pigment spots on the dorsal surface ---- 7
7. Abdomen 2-segmented, three times as long as wide; caudal rami three or four times as long as wide ---- **chelifer** (p. 404)
   Abdomen 1-segmented, only one-third longer than wide; caudal rami one-half longer than wide ---- **belones** (p. 405)
8. Genital segment widest near posterior end, much longer than the abdomen; the latter 2-segmented ---- **mutabilis** (p. 406)
   Genital segment widest at center and not longer than the abdomen; the latter 1- or 2-segmented ---- 9
9. Genital segment squarely truncated posteriorly without lobes; abdomen always 2-segmented ---- **pelamydis** (p. 406)
   Genital segment deeply reentrant posteriorly, with broad lobes; abdomen segments more or less fused ---- **bonito** (p. 407)

MALES

1. Abdomen, without caudal rami, shorter than genital segment ---- 2
   Abdomen, without caudal rami, about as long as genital segment ---- 4
   Abdomen, without caudal rami, longer than genital segment ---- 5
2. Abdomen 2-segmented; genital segment nearly twice as long as wide, without leg rudiments ---- **mutabilis** (p. 406)
   Abdomen 1-segmented; genital segment with leg rudiments ---- 3

3. Posterior margin of genital segment convex, leg rudiments scarcely reaching the abdomen	curtus (p. 399)
Posterior margin of genital segment concave, leg rudiments reaching middle of abdomen	balistae (p. 400)
4. The 2 abdominal segments about same length; genital segment widest near posterior end	bonito (p. 407)
Terminal abdominal segment three times as long as basal; genital segment widest at its center	rufimaculatus (p. 402)
5. Genital segment widest near posterior end, with a pair of leg rudiments on lateral margins	schistonyx (p. 401)
Genital segment widest at its center, without leg rudiments	rapax (p. 403)

CALIGUS CURTUS Müller

Figure 245

Caligus curtus Müller, Entomostraca, p. 130, pl. 21, fig. 1, 1785.—Wilson, Proc. U. S. Nat. Mus., vol. 28, p. 578, pl. 10, 1905.

Occurrence.—Found at Woods Hole on the outside surface of the cod, hake, haddock, pollack, halibut, and barn-door skate.

Distribution.—English seas (T. Scott, Baird, Norman, Brady); North Sea (Timm, Hansen); coast of Belgium (Beneden); Kattegat and Skager Rak (Olsson); coast of Greenland (Fabricius, Ström); Mediterranean (Brian); off Long Island (Pickering and Dana); Vineyard Sound (Smith, Rathbun); coast of Ireland (Pearson); coast of Norway (Rathke, Olsson).

Color.—Body a uniform yellowish horn color, marked in older individuals by dendritic spots of ochre-yellow; eye reddish.

Female.—Carapace more than half the entire length, widest behind the center; lunules large and circular; genital segment oblong, with parallel sides and rounded corners; abdomen nearly as wide as long, less than half the length of the genital segment; caudal rami short and curved inward; furca the shape of the letter H. Fourth legs 3-segmented, with four spines and a seta, the inner terminal spine much the longest and dentate; fifth leg rudiments minute and invisible dorsally. Total length, 8–12 mm.

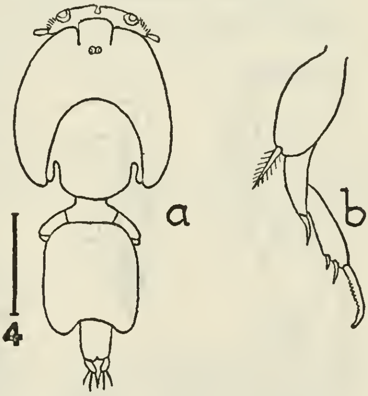

Figure 245.—*Caligus curtus*: *a*, Female, dorsal; *b*, female, fourth leg

Male.—Much larger than female; carapace ovate, as wide as long; genital segment orbicular, wider than long, with convex lateral margins; abdomen 1-segmented, and without the caudal rami distinctly shorter than the genital segment; caudal rami inclined inward and touching at their tips. Second antenna with a rasplike pad on second segment; terminal claw of maxillipeds shutting into a socket on basal segment; fifth legs conspicuous dorsally. Total length, 13–20 mm.

Remarks.—This is the largest species of the genus, and is practically always found upon the external surface of its host. Both sexes are also sometimes taken while swimming freely in the plankton.

CALIGUS BALISTAE Steenstrup and Lütken

FIGURE 246

Caligus balistae STEENSTRUP and LÜTKEN, Kong. Danske Vid. Selsk. Skrift., ser. 5, vol. 5, p. 356, pl. 1, fig. 1, 1861.—WILSON, Proc. U. S. Nat. Mus., vol. 28, p. 601, pl. 15, 1905.

Occurrence.—Both sexes taken from fins of file fish (*Alutera scripta*) at Station 2565, *Albatross*, southeast of Nantucket.

Distribution.—West Indies (Steentrup and Lütken, Wilson); Cape Verde (Brady); Sargasso Sea (Brian).

Color (preserved material).—Body light yellow, tinged in the center of the carapace and genital segment with brown; egg strings orange; eye reddish.

Female.—Carapace more than half the entire length; lunules small, circular, and not projecting; fourth segment very narrow and rhombic; genital segment wider than long, its posterior margin concave, with lobes but no leg rudiments at the corners; abdomen short and wide, 1-segmented; caudal rami small and well separated.

Furca shaped like a bootjack; second segment of maxillipeds with a prominent knob on its outer margin near the proximal end; fourth legs 3-segmented, with four exceptionally long and stout spines. Total length, 4–4.5 mm.

Male.—Carapace twice as long and three times as wide as the rest of the body; fourth segment even smaller than in the female and rhombic; genital segment semilunar, the lobes at the posterior corners long, acuminate, and tipped with leg rudiments. Abdomen 1-segmented, as long and half as wide as the genital segment; caudal rami curved inward but not touching. Total length, 3.5–4 mm.

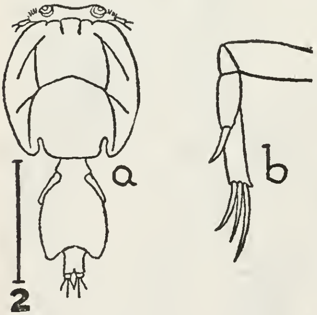

FIGURE 246.—*Caligus balistae: a,* Female, dorsal; *b,* female, fourth leg

Remarks.—This species is a straggler from the West Indies, which comes into the present area upon some wandering tropical fish.

CALIGUS RUFUS Wilson

FIGURE 247

Caligus rufus WILSON, Proc. U. S. Nat. Mus., vol. 33, p. 597, pl. 50, 1908.

Occurrence.—Found on the outer surface and in the gill cavity of the sea catfish (*Felichthys marinus*) at Woods Hole.

Distribution.—Not found outside the Woods Hole area.

Color.—Body a bright orange-yellow, thickly and irregularly penciled above and below with lines and spots of brilliant reddish brown; eye ruby-red.

Female.—Body elongate and narrow; carapace elliptical, more than half the entire length; lunules large, but not projecting; fourth segment short; genital segment longer than wide, with leg rudiments on the ventral surface. Abdomen 1-segmented, tapered strongly backward, the distal end half as wide as the base; caudal rami twice as long as wide, inclined toward each other and meeting at their tips. Rami of third legs widely separated, a claw at base of exopod; fourth leg 3-segmented, with five spines and a seta, the inner terminal spine the longest. Total length, 4.4 mm.

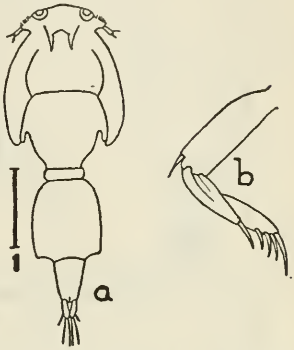

FIGURE 247.—*Caligus rufus*: *a*, Female, dorsal; *b*, female, fourth leg

Male.—Unknown.

Remarks.—This species has thus far been found in no other location and upon no other host. The strongly tapered abdomen is the best single character.

CALIGUS SCHISTONYX Wilson

FIGURE 248

Caligus schistonyx WILSON, Proc. U. S. Nat. Mus., vol. 28, p. 564, pl. 6, 1905.

Occurrence.—Both sexes found on the outside surface of menhaden and bluefish at Woods Hole.

Distribution.—Beaufort, N. C.; Chesapeake Bay (Wilson).

Color.—Body dark yellow, inclining to brown, without any pigment markings; eye dark blue.

Female.—Carapace more than half the entire length; frontal margin squarely truncated; lunules large and circular; fourth segment short and half as wide as the genital segment; the latter with convex sides and projecting lobes at the posterior corners, but without leg rudiments. Abdomen 1-segmented, shorter than the genital segment and less than half as wide; caudal rami widely separated. Terminal claws of first legs bipartite; fourth leg 3-segmented, with six spines and no seta, the inner terminal spine much the longest. Total length, 3.8–4.2 mm.

Male.—Carapace trapezoidal, as wide as long, widest near the posterior margin; fourth segment as wide as the genital segment and longer than in the female; genital segment one-fourth the width of the carapace, with leg rudiments on its lateral margins behind the center. Abdomen 2-segmented, end segment three times as long as basal segment, the two combined longer than the genital segment; caudal rami as wide as long, their inner margins ciliated. Total length, 2.8–3.2 mm.

Remarks.—Both sexes, especially the males, are sometimes captured while swimming freely in the plankton. The species can be identified most easily by the divided terminal claws on the first legs.

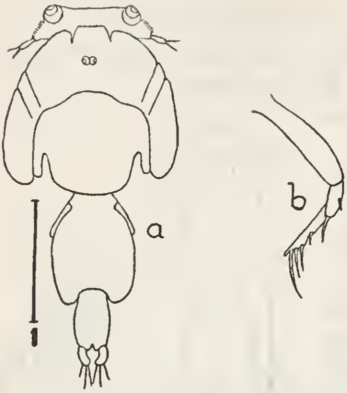

FIGURE 248.—*Caligus schistonyx: a,* Female, dorsal; *b,* female, fourth leg

CALIGUS RUFIMACULATUS Wilson

FIGURE 249

Caligus rufimaculatus WILSON, Proc. U. S. Nat. Mus., vol. 28, p. 561, pl. 5, 1905.

Occurrence.—Both sexes found on the outside surface of the two species of *Fundulus* so common around Woods Hole, and on the mullet; also captured in the surface tow off the wharf of the Bureau of Fisheries.

Distribution.—Not found outside of the present area.

Color.—Body pale straw yellow, covered on both dorsal and ventral surfaces with irregularly scattered spots and lines of reddish-brown pigment, more numerous on the genital segment; eye a deep red.

Female.—Carapace more than half the entire length; frontal margin squarely truncated; lunules large and widely separated; genital segment as wide as long, widest near the posterior margin, its posterior corners without lobes or leg rudiments. Abdomen 1-segmented, three-fourths as long as genital segment; caudal rami short and stout, with convex inner margins. Furca the shape of an hourglass, with flattened branches; fourth legs 3-segmented, with five spines and one seta, the inner terminal spine the longest. Total length, 3.5–3.7 mm.

Male.—Carapace relatively much larger than in the female; fourth segment nearly as wide as the genital segment and a third as long;

genital segment with leg rudiments on its lateral margins posterior to the center. Abdomen 2-segmented, the basal segment less than half the length of the end segment; caûdal rami large and lamellar, with convex inner margins. Total length, 2.8–3.1 mm.

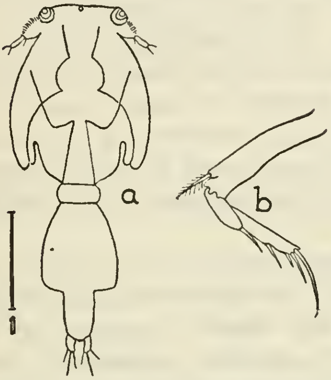

FIGURE 249.—*Caligus rufimaculatus: a,* Female, dorsal; *b,* female, fourth leg

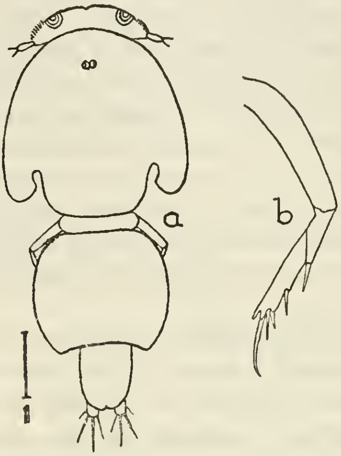

FIGURE 250.—*Caligus rapax: a,* Female, dorsal; *b,* female, fourth leg

Remarks.—This species may be recognized by its color when alive, and by the shape and relative proportions of the genital segment in the two sexes.

CALIGUS RAPAX Milne Edwards

FIGURE 250

Caligus rapax MILNE EDWARDS, Histoire naturelle des Crustacés, vol. 3, p. 453, pl. 38, 1840.—WILSON, Proc. U. S. Nat. Mus., vol. 28, p. 568, pl. 7, 1905.

Occurrence.—Found upon the outside surface of the following fishes: Common and 4-spotted flounders, codfish, haddock, pollack, common and white hakes, lumpfish, mackerel, scup, striped bass, alewife, sturgeon, sting ray, barn-door skate, big skate, common skate, spiny dogfish, whiting, shad, swordfish, rudderfish, sand shark, remora, cutlass fish, sand launce, northern gurnard, torpedo ray, smooth dogfish, halibut, crevalle, common sculpin, and *Raja eglanteria.*

Distribution.—British seas (Brady, T. Scott, Norman); North Sea (Timm); Greenland (Hansen); North Atlantic (Brian); Woods Hole (Rathbun, Wilson).

Color.—Ground color pale orange, the dorsal surface irregularly spotted with dark reddish brown, each spot made up of a center and long radiating filaments. The spots are thickest along the margins of the carapace and the sides of the genital segment and the abdomen, leaving the middle of the body comparatively free. Eye deep ruby-red.

Female.—Carapace ovate, about half the entire length, frontal margin convex; lunules large and projecting; fourth segment short and about one-third the width of the carapace; genital segment quadrangular, wider than long, without lobes or leg rudiments. Abdomen 1-segmented, a third as wide and a half as long as the genital segment; caudal rami short and wide. Fourth leg 3-segmented, with five spines and no seta. Total length, 5–7 mm.

Male.—Carapace as wide as long; lunules larger than in the female; fourth segment as wide as the genital segment and more than a third as long; genital segment spindle-shaped, without leg rudiments. Abdomen as long as genital segment, 2-segmented, the basal segment a little more than half as long as the end segment. Total length, 4–5 mm.

Remarks.—This is the most common species of the genus and apparently infests any host that offers. It may be recognized by the pigment spots on the female and by the relative length of the two abdominal segments in the male. Both sexes, especially young females and males, are often taken in surface tows, and are fully as active as any of the free swimmers.

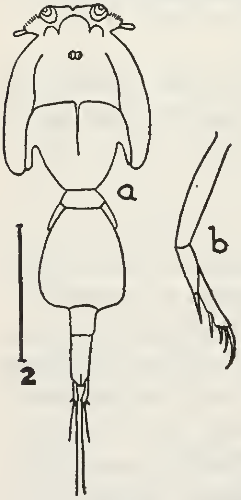

FIGURE 251.—*Caligus chelifer: a,* Female, dorsal; *b,* female, fourth leg

CALIGUS CHELIFER Wilson

FIGURE 251

Caligus chelifer WILSON, Proc. U. S. Nat. Mus., vol. 28, p. 582, pl. 11, 1905.

Occurrence.—Found on the external surface of the menhaden, the swordfish, and the cutlass fish at Woods Hole.

Distribution.—West coast of Africa in plankton (Brian).

Color.—Body a more or less transparent yellow, very thickly spotted on both dorsal and ventral surfaces with branching pigment blotches and lines of light rusty brown; eye deep ruby-red.

Female.—Carapace ovate, about half the entire length; lunules large, circular, and somewhat projecting; fourth segment one-fourth the width of the carapace; genital segment acorn-shaped, as wide as long, squarely truncated in females bearing egg strings, evenly rounded in immature females. Abdomen slender, 2-segmented, terminal segment twice the length of the basal; caudal rami cylindrical, three times as long as wide, inclined inward toward each other. Base of the furca longer than the branches, the latter U-shaped; two middle terminal claws of the first leg branched; fourth leg 3-segmented, with five spines and no seta. Total length, 5–6.5 mm.

Male.—Unknown.

Remarks.—This species may be identified by the peculiar chela on the maxillipeds, which is the only instance of its kind in this genus. The swordfish is its chief host, and if these could be examined when first taken out of the water they would probably yield specimens of this parasite.

CALIGUS BELONES Krøyer

FIGURE 252

Caligus belones KRØYER, Naturh. Tidsskrift, ser. 3, vol. 2, p. 81, pl. 7, 1863.—WILSON, Proc. U. S. Nat. Mus., vol. 28, p. 586, pl. 12, 1905.

Occurrence.—Two females were found on the outside surface of a small dolphin near Woods Hole.

Distribution.—Denmark (Krøyer); Norway and Sweden (Olsson); Woods Hole (Wilson).

Color.—The preserved material is of a light yellowish brown without any traces of pigment markings.

Female.—Carapace about half the entire length; lunules large, circular, and not projecting; fourth segment two-thirds as wide as genital segment, much narrowed where it joins the third segment; genital segment half the width of the carapace, emarginate posteriorly, without leg rudiments. Abdomen 1-segmented, twice as long as wide, with convex lateral margins; caudal rami short and wide; furca shaped like a tuning fork; fourth leg 3-segmented, with four spines and no seta. Total length, 4.75– mm.

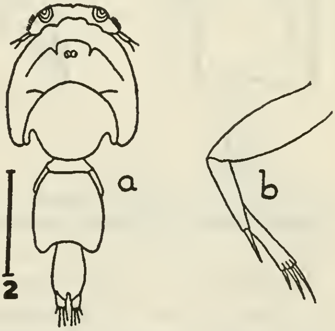

FIGURE 252.—*Caligus belones: a,* Female, dorsal; *b,* female, fourth leg

Male.—Carapace less than half the entire length; genital segment circular in outline, as wide as long, with leg rudiments at its posterior corners. Abdomen as long as genital segment, 2-segmented, the terminal segment twice the length of the basal; caudal rami narrowed distally; fourth legs reaching the anal segment. Total length, 4–5 mm.

Remarks.—This species can be identified by the shape of the furca and by the fact that the fourth legs have but four spines and no seta.

CALIGUS MUTABILIS Wilson

FIGURE 253

Caligus mutabilis WILSON, Proc. U. S. Nat. Mus., vol. 28, p. 573, pl. 8, 1905.

Occurrence.—Both sexes found in the mouth of the blackfish, striped bass, pollack, and bonito at Woods Hole.

Distribution.—Not found outside the present area.

Color.—Body a light horn yellow, delicately penciled with small spots and lines of pink and red, which are most prominent along the dorsal midline and on the posterior lobes of the carapace; eye bright ruby red.

Female.—Carapace less than half the entire length; lunules large, circular, and projecting slightly; fourth segment one-fourth the width of the carapace, strongly narrowed in front of the fourth legs; genital segment flask-shaped, contracted into a short waist anteriorly, slightly concave posteriorly, without lobes or leg rudiments. Abdomen 2-segmented, segments about equal; caudal rami small, widely separated; furca the shape of a rounded Y; fourth leg 3-segmented, with five spines and no seta. Total length, 5–5.75 mm.

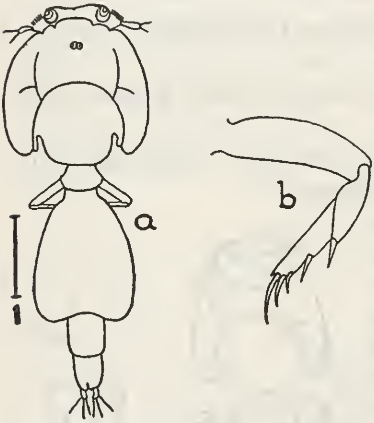

FIGURE 253.—*Caligus mutabilis: a,* Female, dorsal; *b,* female, fourth leg

Male.—Carapace more than half the entire length; fourth segment wider than the genital segment and contracted but little in front of the fourth legs; genital segment spindle-shaped, one-half longer than wide, without leg rudiments. Abdomen 2-segmented, the basal segment more than half as long as the end segment; caudal rami large and laminate, as wide as long. Total length, 3–3.5 mm.

Remarks.—This species can be distinguished from the others here included by the fact that the abdomen is as long as the genital segment and 2-segmented. The shape and relative size of the genital segment in the female, however, vary greatly with the stage of development of the individual, whence the specific name.

CALIGUS PELAMYDIS Krøyer

FIGURE 254

Caligus pelamydis KRØYER, Naturh. Tidsskrift, ser. 3, vol. 2, p. 50, pl. 4. 1863.—WILSON, Proc. U. S. Nat. Mus., vol. 28, p. 594, pl. 13, 1905.

Occurrence.—Found on the gills of the oceanic bonito (*Gymnosarda pelamis*) at Woods Hole.

Distribution.—Denmark (Krøyer); Mediterranean (Richiardi); coast of Italy (Brian); South African coast (Brady); Woods Hole (Wilson).

Color.—Body a uniform yellowish white, lighter on the genital segment, which is almost pure white; eye reddish.

Female.—Carapace less than half the entire length; lunules minute and not projecting; fourth segment one-fourth the width of the carapace; genital segment acorn-shaped, squarely truncated posteriorly, without leg rudiments. Abdomen one-fourth longer than genital segment, 2-segmented, the basal segment five times as long as the terminal segment; caudal rami small and inclined toward each other. Fourth legs 4-segmented, with five spines and no seta; furca short, with very wide and curved branches. Total length, 3–4 mm.

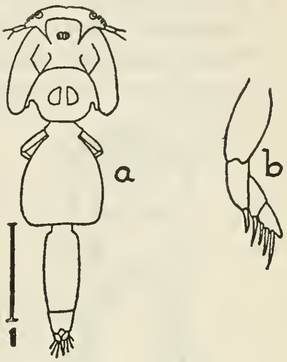

Figure 254.—*Caligus pelamydis: a,* Female, dorsal; *b,* female, fourth leg

Male.—Unknown.

Remarks.—This is the only species here presented in which the fourth legs are 4-segmented. Krøyer has figured two pairs of leg rudiments on the genital segment, but none were found on these American specimens.

CALIGUS BONITO Wilson

Figure 255

Caligus bonito Wilson, Proc. U. S. Nat. Mus., vol. 28, p. 589, pl. 13, 1905.

Occurrence.—Both sexes found in the mouth and gill cavity of the oceanic bonito (*Gymnosarda pelamis*) in company with the preceding species at Woods Hole.

Distribution.—West coast of Africa (Brian).

Color.—Body a pale transparent yellow, the tips of the lateral lobes of the carapace and the adjacent thoracic area on the dorsal surface thickly spotted with light rusty brown. The copepod thus appears to have two large brown eyes at the posterior corners of the carapace; true eyes light red.

Female.—Carapace less than half the entire length; lunules large, circular, not projecting; fourth segment one-third the width of the carapace; genital segment two-thirds as wide and nearly as long as the carapace, contracted into a very short waist anteriorly, with broadly rounded posterior lobes without leg rudiments. Abdomen as long as genital segment but only half as wide, apparently 1-segmented, but really two segments fused as shown by its development;

caudal rami large, and laminate; fourth leg 3-segmented, with five spines and no seta. Total length, 8–8.5 mm.

Male.—Carapace more than half the entire length, as wide as long; fourth segment wider than genital segment and somewhat narrowed anteriorly; genital segment barrel-shaped, without posterior lobes or leg rudiments. Abdomen as long as genital segment, 2-segmented, the segments equal in length and width; maxilliped with powerful end claw shutting down against a bony plate on the basal segment, thus making a strong clasping organ. Total length, 5–5.5 mm.

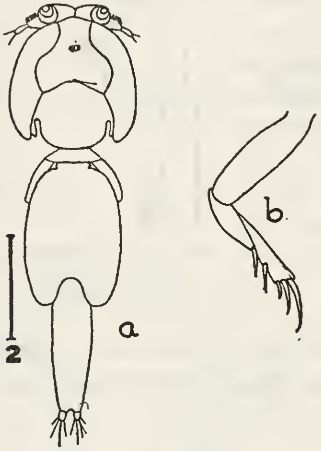

Figure 255.—*a, Caligus bonito:* Female, dorsal; *b,* female, fourth leg

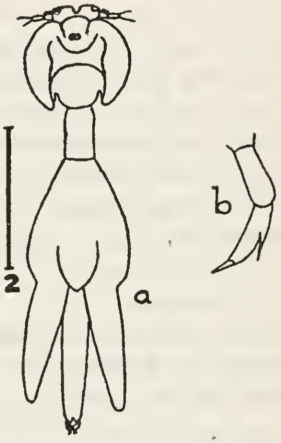

Figure 256.—*Caligodes megacephalus: a,* Female, dorsal; *b,* female, fourth leg

Remarks.—This species is very lively and can move about over the skin of its host with great agility. In an aquarium the female quickly sloughs off her eggs, and both sexes crawl out of the water and remain there until killed by drying.

Genus CALIGODES Heller, 1865

Carapace only one-fourth the entire length or less; frontal plates with lunules; fourth segment narrow and elongated, forming a waist connecting the carapace with the genital segment. The latter is acorn-shaped and prolonged at its posterior corners into processes as long as the abdomen, tapered and bluntly pointed. Abdomen 1-segmented, narrow and longer than the genital segment. First and fourth legs uniramose, second and third legs biramose; fifth legs lacking; furca large and prominent; antennae and mouth parts similar to those in *Caligus.* A single species in the present area.

CALIGODES MEGACEPHALUS Wilson

FIGURE 256

Caligodes megacephalus WILSON, Proc. U. S. Nat. Mus., vol 28, p. 609, pl. 16, 1905.

Occurrence.—A single female from the mouth of a silver gar (*Lepisosteus osseus*) at Woods Hole.

Distribution.—Not found outside the present area.

Color.—Body a uniform dark yellowish brown, the abdomen and egg strings darker than the other parts; eye brick red.

Female.—Carapace orbicular, a little longer than wide; lunules small, semilunar, not projecting; fourth segment half the length and a third the width of the carapace; genital segment without its posterior processes as long as the carapace and fourth segment combined, widest at posterior end, where on the dorsal surface is a horseshoe-shaped median lobe, the toe pointed backward. Abdomen six times as long as wide; caudal rami minute, inclined inward, their tips touching. First legs with a single terminal claw; fourth legs 2-segmented, with two spines, one terminal, the other lateral on the end segment. Total length, 6.1 mm.

Male.—Unknown.

Remarks.—This genus and species can be identified at once by the general appearance and the proportions of the different parts.

Genus LEPEOPHTHEIRUS Nordmann, 1832

Head fused with first three segments and covered with a carapace; fourth segment free, without dorsal plates; fifth and genital segments fused; abdomen 1- or 2-segmented; caudal rami short and wide. No lunules; maxillae small and bifurcate; maxillary palp and furca both present; first and fourth legs uniramose, second and third legs biramose; one or two pairs of leg rudiments often present on the fused fifth–genital segment. Egg strings often longer than the body.

KEY TO THE SPECIES

FEMALES

1. Carapace one-half shorter than rest of body; abdomen 2-segmented, basal four times as long as end segment______ thompsoni (p. 410)
   Carapace distinctly longer than rest of body; abdomen 1-segmented____2
2. Genital segment as wide as long, fourth legs not reaching its center; branches of furca undivided_________________ edwardsi (p. 412)
   Genital segment longer than wide, elliptical in outline____________________3
3. Fourth legs reaching behind center of genital segment; branches of furca wrinkled but not divided__________________ nordmannii (p. 411)
   Fourth legs reaching posterior lobes of genital segment; branches of furca divided but not wrinkled__________________ hippoglossi (p. 412)

MALES

1. Abdomen 2-segmented, basal one-third as long as end segment; carapace as wide as long---------------------------- nordmanii (p. 411)
   Abdomen 1-segmented; carapace distinctly longer than wide--------------- 2
2. Fourth legs reaching beyond tips of caudal rami; genital segment not so wide as fourth segment---------------- hippoglossi (p. 412)
   Fourth legs scarcely reaching center of genital segment; the latter wider than fourth segment--- 3
3. Genital segment obovate, widest anteriorly; spines on fourth legs flanged-- edwardsi (p. 412)
   Genital segment orbicular, widest at its center; spines on fourth legs not flanged-------------------------------------- thompsoni (p. 410)

LEPEOPHTHEIRUS THOMPSONI Baird

FIGURE 257

Lepeophtheirus thompsoni BAIRD, The natural history of the British Entomostraca, p. 278, pl. 33, fig. 2, 1850.—WILSON, Proc. U. S. Nat. Mus., vol. 28, p. 619, pl. 18, 1905.

Occurrence.—Both sexes found on outside surface of goosefish at Woods Hole by Vinal Edwards in 1904.

Distribution.—British seas (Baird, T. Scott, Bassett-Smith, White); Mediterranean (Brian); Faroe Islands (Hansen); Kattegat and North Sea (Krøyer); Bohuslän (Malm, Olsson); La Jolla, Calif. (Wilson).

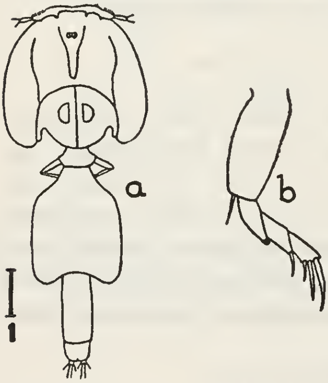

FIGURE 257.—*Lepeophtheirus thompsoni: a*, Female, dorsal; *b*, female, fourth leg

Color.—Body a uniform light yellow, turning dark brown in preservatives.

Female.—Carapace a little wider than long and less than half the entire length; fourth segment less than half the width of the genital segment, strongly narrowed in front of the fourth legs; genital segment flask-shaped, narrowed anteriorly, emarginate posteriorly, with broad lobes but no leg rudiments.

Abdomen 2-segmented, the basal segment four times as long as the terminal; caudal rami minute and widely separated. Furca large and broadly U-shaped; fourth legs 4-segmented, with four spines and a seta. Total length, 7–8.4 mm.

Male.—Carapace elliptical, longer than wide, and much more than half the entire length; fourth segment spindle shaped; genital segment orbicular, as wide as long, with two pairs of leg rudiments at the posterior corners. Abdomen half the length of the genital segment, made up of a single segment, considerably narrowed basally. Fourth legs scarcely reaching the center of the genital segment, their basal segment unarmed. Total length, 4–4.5 mm.

Remarks.—Probably nowhere among the parasitic copepods has there been any greater attempt to create several species out of one than in the present instance. This is fully discussed in the reference given above; here it is sufficient to say that the species may be recognized by the characters given in the two keys on pages 409, 410.

LEPEOPHTHEIRUS NORDMANNII (Milne Edwards)

FIGURE 258

Caligus nordmannii MILNE EDWARDS, Histoire naturelle des Crustacés, vol. 3, p. 455, 1840.—WILSON, Proc. U. S. Nat. Mus., vol. 28, p. 623, pl. 19, 1905.

Occurrence.—Found on the outside surface of the sunfish at Woods Hole.

Distribution.—Mediterranean (Heller, Stossich, Milne Edwards, Richiardi, Elwes); English seas (White, Baird, T. Scott); California coast (Wilson).

Color.—Body a uniform yellowish white, covered with tiny dots of reddish brown.

Female.—Carapace orbicular, as wide as long; fourth segment half the width of the genital segment, strongly narrowed in front of the fourth legs; genital segment less than half the width of the carapace, with wide posterior lobes, but without leg rudiments. Abdomen spindle-shaped, half as long as the genital segment; caudal rami long and slender. Branches of the furca long, divergent, and transversely wrinkled; fourth leg 4-segmented, with six spines and no seta, reaching well beyond the center of the genital segment. Total length, 10–12 mm.

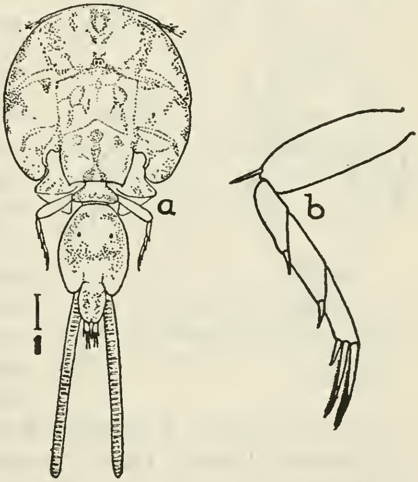

FIGURE 258.—*Lepeophtheirus nordmannii*: *a*, Female, dorsal (drawn by Emerton); *b*, female, fourth leg

Male.—Carapace longer than the rest of the body; fourth segment longer and narrower than in the female; genital segment flask-shaped, longer than wide, narrowed anteriorly and deeply concave posteriorly, with two pairs of pointed posterior processes carrying leg rudiments. Abdomen 2-segmented, the basal segment the wider, the end segment the longer; caudal rami narrow and curved like parentheses. Total length, 5–6 mm.

Remarks.—This species is apparently confined to the sunfish, and may be looked for whenever that peculiar fish is found.

LEPEOPHTHEIRUS HIPPOGLOSSI (Krøyer)

Figure 259

Caligus hippoglossi Krøyer, Naturh. Tidsskrift, vol. 1, p. 625, pl. 6, fig. 3, 1837.
Lepeophtheirus hippoglossi Wilson, Proc. U. S. Nat. Mus., vol. 28, p. 625, pl. 20, 1905.

Occurrence.—Found on the outside surface of halibut caught off Nantucket.

Distribution.—Greenland (Krøyer, Stephensen); Iceland (Hansen); British seas (Baird, Thompson, T. Scott); Irish Sea (Schmidt); Belgian coast (Beneden); Woods Hole (Rathbun, Wilson).

Color.—Body a light yellow with spots of pink or red scattered irregularly over the dorsal surface and on the basal segments of the fourth legs; eye red.

Female.—Carapace longer than wide, more than half the entire length; fourth segment four-fifths as wide as genital segment, strongly narrowed in front of fourth legs; genital segment half the width of carapace, with narrow posterior lobes but no leg rudiments. Abdomen 1-segmented, one-fourth the length and width of the genital segment; caudal rami short and wide. Branches of the furca bipartite, the rami strongly flattened and squarely truncated; fourth legs 4-segmented, with four spines. Total length, 10–12 mm.

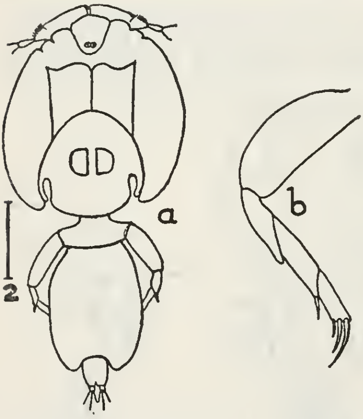

Figure 259.—*Lepeophtheirus hippoglossi: a,* Female, dorsal; *b,* female, fourth leg

Male.—Carapace as wide as long, twice as long as the rest of the body; fourth segment wider than the genital segment; the latter the same length and width, with two pairs of leg rudiments at its posterior corners. Abdomen quadrangular, 1-segmented; fourth legs reaching beyond the tips of the caudal rami; furca bipartite as in the female. Total length, 7–7.5 mm.

Remarks.—This is the only American species in which the branches of the furca are bipartite. Though it is chiefly confined to the halibut, as its name implies, it is occasionally found upon rays and sharks.

LEPEOPHTHEIRUS EDWARDSI Wilson

Figure 260

Lepeophtheirus edwardsi Wilson, Proc. U. S. Nat. Mus., vol. 28, p. 627, pl. 21, 1905.

Occurrence.—Found upon the outside surface of the summer flounder, 4-spotted flounder, horse crevalle, garfish, summer skate, and goosefish at Woods Hole.

Distribution.—Not found outside the present area.

Color.—Body a uniform pinkish yellow, with spots of purple-brown pigment scattered evenly over the entire dorsal surface, so that the color is uniform everywhere; eye deep red.

Female.—Carapace ovate, widest posteriorly; fourth segment half the width of the genital segment, much narrowed in front of the fourth legs; genital segment nearly as wide as long, with parallel sides and rounded corners, without lobes but with rudiments of fifth legs on the ventral surface. Abdomen 1-segmented, wider than long; caudal rami very short and wide. Branches of the furca strongly flattened, roundly truncated, much wider than long, with radiating ridges; fourth legs 4-segmented, with five spines and one seta. Total length, 6.5–7.5 mm.

Male.—Carapace nearly twice as long as the rest of the body; fourth segment diamond-shaped, a little more than half the width of the genital segment; the latter wider than long, with the rudiments of two pairs of legs at its posterior corners. Abdomen 1-segmented, one-third the length and width of the genital segment; fourth legs 4-segmented, with five spines and one seta, the spines with dentate flanges. Total length, 3–3.6 mm.

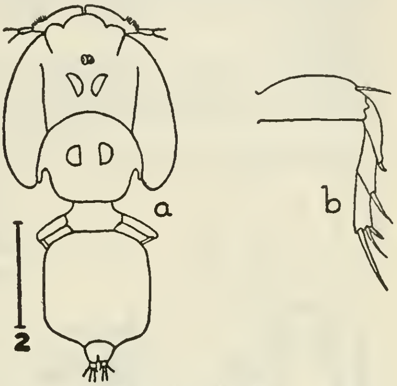

FIGURE 260.—*Lepeophtheirus edwardsi*: *a*, Female, dorsal; *b*, female, fourth leg

Remarks.—This species may be identified most easily by the structure of the furca, and is quite common on the two flounders mentioned above.

Family TREBIDAE

Genus TREBIUS Krøyer, 1838

Head fused with first and second thoracic segments, third and fourth segments free and without dorsal plates; carapace strongly arched dorsally; no lunules; genital segment well developed, without lobes. Abdomen narrow and elongate, 1- to 3-segmented; all four pairs of legs biramose, rami of first pair 2-segmented, of other three pairs 3-segmented, fourth endopod sometimes 2-segmented; two pairs of leg rudiments on genital segment in male, one pair in female; maxillary hook and furca both present as in the Caligidae; maxillae simple or bipartite.

TREBIUS TENUIFURCATUS Rathbun

FIGURE 261

Trebius tenuifurcatus RATHBUN, Proc. U. S. Nat. Mus., vol. 10, p. 559, pl. 29, 1887.—WILSON, Proc. U. S. Nat. Mus., vol. 31, p. 679, pl. 15, 1907; vol. 35, p. 447, pl. 72, 1908.

Occurrence.—Found on the outside surface of a sting ray captured in the fish nets at Menemsha Bight, Marthas Vineyard.

Distribution.—Woods Hole (Rathbun); San Diego, Calif. (Wilson).

Color.—Body a uniform yellowish white with a very scattered tracery of minute spots and lines of a bright reddish brown. These are widely scattered on the carapace and free segments but are closer together on the genital segment and along the lateral margins of the abdomen. Eye bright ruby-red.

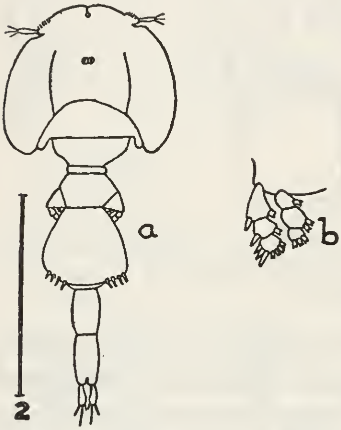

FIGURE 261.—*Trebius tenuifurcatus*: *a*, Female, dorsal; *b*, female, fourth leg

Female.—Carapace one-third wider than long, lateral lobes wide and blunt; eyes large and prominent; third segment much narrowed posteriorly; fourth segment the same length and width, rhomboidal; genital segment flask-shaped, narrowed anteriorly, with four large spines at each posterior corner on the dorsal surface and one pair of leg rudiments on the ventral surface. Abdomen five times as long as wide, 2-segmented, segments about equal; maxillae bipartite; furca with elongate rami; endopod of fourth legs 3-segmented. Total length, 4–4.65 mm.

Male.—Carapace as long as wide; third segment much shorter than the fourth but wider; fourth segment wider than genital segment and two-thirds as long; genital segment longer than wide, with two pairs of leg rudiments. Abdomen 2-segmented, terminal segment twice the length of the basal; branches of furca curved like parentheses. Total length, 1.75–2.25 mm.

Remarks.—Rathbun's original description of this species was from a single female, which had evidently shrunken in the preservative. Since then fresh specimens of both sexes have been obtained, and the description has been completed as above. The species can be recognized by the large dorsal spines at the posterior corners of the genital segment in the female.

Family EURYPHORIDAE

Genus GLOIOPOTES Steenstrup and Lütken, 1861

Head fused with the first three thoracic segments and covered with a carapace like that in the Caligidae; no lunules; fourth segment with a pair of dorsal plates, which overlap the genital segment and the basal segments of the fourth legs; genital segment in female produced at each posterior corner into a curved process, carrying a serrated styliform appendage on its outer margin, in the male without processes, but with the styliform appendages attached directly to its sides. Abdomen slender, 2-segmented; caudal rami filiform. First and fourth legs uniramose, second and third biramose, rami 3-segmented; terminal claws on first legs tripartite; furca compound, its branches bifid. A single species.

GLOIOPOTES ORNATUS Wilson

Figure 262

Gloiopotes ornatus Wilson, Proc. U. S. Nat. Mus., vol. 31, p. 699, pl. 17, 1907.

Occurrence.—Both sexes were obtained from the outside of the swordfish and the spearfish at Woods Hole, July, 1924.

Distribution.—Not found outside the present area.

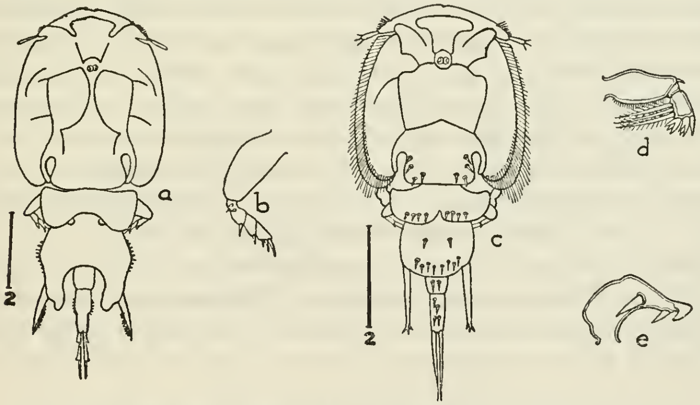

Figure 262.—*Gloiopotes ornatus:* *a,* Female, dorsal; *b,* female, fourth leg; *c,* male, dorsal; *d,* male, first leg; *e,* male, second antenna

Color.—Body a uniform yellowish white, the digestive tract and reproductive organs deepened to a light orange; eye a dull brick red.

Female.—Carapace longer than wide and strongly arched, the lateral margins and especially the posterior lobes with a fringe of long hairs; median lobe with a row of spines near the margin on the dorsal surface; genital segment with convex lateral margins fringed with a row of spines; other spines scattered over the dorsal surface.

Abdomen cylindrical, 2-segmented, terminal segment twice as long as basal, with a knob armed with spines on its dorsal surface near the center of the segment. Caudal rami filiform, without setae; branches of furca bifid; fourth leg 4-segmented with five stout spines and no seta. Total length, 10–12 mm.

Male.—Carapace one-fifth longer than wide and rather depressed, a fringe of hairs along the lateral margins and around the posterior lobes even longer than in the female; four small spines on either half of the median lobe. Dorsal wings of the fourth segment considerably wider than the genital segment and turned forward at their outer corners, with a narrow posterior median sinus. Each wing has a row of four small spines on its dorsal surface along the posterior margin. Genital segment orbicular, as wide as long, with a single spine on the dorsal surface on either side of the midline near the center of the segment, and an irregular row of eight spines along the posterior margin, also on the dorsal surface. There are no posterior lobes, but the spiny processes are attached directly to the segment itself; each is slender, extends backward parallel with the abdomen, and reaches beyond the tip of the latter, with three minute apical spines. Abdomen 2-segmented, the terminal segment twice the length of the basal, both segments with straight sides and armed dorsally with a few small spines. Caudal rami as long as the entire abdomen, strongly flattened laterally, closely appressed, each with a single apical seta.

The second antenna carries a stout spine on the inner margin of the terminal claw and a second larger one on the ventral surface near the base of the claw. The inner setae of the end segment of the first legs are exceptionally stout and extend inward to the base of the proximal segment. The second endopod segment of the second legs is as wide as long, with a large rounded flap on its outer margin. Total length, 8 mm., including caudal rami.

Remarks.—The male is here described for the first time and completes the establishment of the species. The new host, the spearfish (*Tetrapturus imperator*), is a southern form and is only captured occasionally in the present area.

Genus ELYTROPHORA Gerstaecker, 1853

First three thoracic segments fused with the head; carapace flatly arched, as wide as long, with short and broadly rounded posterior lobes; fourth segment with a pair of small dorsal plates slightly overlapping the genital segment, fused at their base. Genital segment of medium size, longer than wide, with broad lobes at the posterior corners. Abdomen 2-segmented; caudal rami laminate, with setae; first four pairs of legs biramose, rami of first pair 2-segmented, of second and third pairs 3-segmented, exopod of fourth pair 3-segmented, endopod 2-segmented; fifth leg rudiments present in the male; a furca present but no maxillary hook. One species.

ELYTROPHORA ATLANTICA, new species

PLATES 1, *d;* 25

Occurrence.—Twenty specimens, including both sexes, were obtained from the gills of the horse mackerel (*Thunnus thynnus*) at Woods Hole, July, 1915. One of these, a female, has been selected as the holotype with U.S.N.M. No. 56623. The others become paratypes with U.S.N.M. No. 56601.

Color.—Carapace grayish white, with small pigment spots irregularly scattered over the dorsal surface; genital segment orange-yellow; egg strings gray; eye reddish brown.

Female.—Carapace orbicular, a little wider than long, with strongly convex lateral margins, the posterior lobes short and broadly rounded, the median lobe squarely truncated. The furrowing of the dorsal surface of the carapace is different from that in the species already described; the central area is trapezoidal, widest anteriorly, with sharply rounded anterior corners, straight sides and a concave posterior margin. From each anterior corner a curved groove runs forward, outward, and then backward parallel with the lateral margin of the carapace. The center of this central area projects forward as a rounded knob, with the eye just in front of it. Each lateral area is divided by a transverse groove, which joins the central area at its posterior corner. The fourth segment forms a short narrow waist anteriorly, and is covered posteriorly by a pair of elliptical dorsal plates, or wings, inclined toward each other and overlapping at their tips; the outer margin of each plate is invaginate near its center. Genital segment barrel shaped, with broad posterior lobes curved inward over the basal abdominal segment; as in the species *hemiptera* these lobes are separated from the rest of the segment by distinct grooves, and are darker in color. The abdomen is 2-segmented, the basal segment longer than the terminal, with tiny lobes at its posterior corners. The caudal rami are shorter than the anal segment, nearly as wide as long, each tipped with three nonplumose setae.

The frontal plates are narrow and project but little; the second antennae are large and stout; the terminal claw is turned back against the ventral surface of the head and curved sharply near its tip, with a long seta on the outer margin. The second segment also carries a spine on its ventral surface, and the two basal segments are fully as long as the apical claw. The maxilla is stout, simple, and slightly curved; the strong apical claw of the maxilliped is bent into a half circle, the point shutting down against the basal segment. The furca is three times as long as wide, the basal half stout, with convex sides, the branches slender and slightly curved.

The basal segment of the first leg is armed only with a minute filiform seta; the endopod is much reduced, while the exopod is large and stout, with three apical spines and a plumose seta. In the second leg the first and second segments of the exopod have a spine at the outer distal corner and a plumose seta on the inner margin, the end segment has two spines on its outer margin and one on the ventral surface, and five setae. The second segment of the endopod of the second leg is prolonged inside the end segment, and terminates in two setae. The endopod of the fourth leg is 2-segmented and just reaches the distal margin of the second exopod segment; its basal segment is unarmed, its end segment has two apical, one outer, and one inner spine. The genital segment shows no leg rudiments. The egg strings are rather slender and as long as the entire body. Total length, 8–9 mm. Width of carapace, 4–4.5 mm.

Male.—Carapace like that of the female, with similar grooving; the frontal plates are less prominent but the eye is larger and more distinct. The dorsal plates of the fourth segment have a knoblike projection at each anterior corner and no invagination on the outer margins. The genital segment is elliptical, without posterior lobes but with leg rudiments on the lateral margins just behind the center. The abdomen is 2-segmented, the segments equal, the basal one without posterior lobes; the caudal rami are as wide as long, each tipped with three setae.

The terminal claw of the second antenna is turned down against the ventral surface of the head, is bent into the shape of the letter U, and has two small spines on its ventral surface near the base; the second segment also has a spine on its ventral surface near the posterior margin. Total length, 6–6.5 mm. Width of carapace, 2.5–3 mm.

Remarks.—This new species is very similar to *hemiptera* established upon material obtained in Japan.[14] The two can be distinguished by the frontal plates, the grooving of the carapace, the relative size and shape of the dorsal plates on the fourth segment, the posterior lobes of the genital segment, and the caudal rami.

Genus ALEBION Krøyer, 1863

Carapace elliptical, as wide as long; no lunules; fourth segment with dorsal plates in female, which are much reduced or lacking in male. Genital segment in female usually produced into a long process at each posterior corner, extending backward beyond the tip of

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[14] Proc. U. S. Nat. Mus., vol. 59, no. 2354, p. 4, 1921.

the abdomen, in the male usually smoothly rounded. Abdomen 2-segmented in both sexes, the basal segment in female with long processes at its posterior corners; caudal rami large with long setae. First three pairs of legs biramose, the exopods with very large horny claws; rami of first pair 2-segmented, of second and third pairs 3-segmented; fourth legs rudimentary, consisting of a single segment; no furca or maxillary hook; leg rudiments often present in the male on genital segment.

KEY TO THE SPECIES

FEMALES

1. Genital segment quadrangular, with rounded corners and without posterior processes---------------------------------- glaber (p. 419)
   Genital segment elliptical, with long conical processes, extending beyond tip of abdomen--- 2
2. Carapace distinctly longer than wide, median lobe broad, reaching far behind tips of lateral lobes------------------------------------ 3
   Carapace as wide as long or wider, median lobe not reaching tips of lateral lobes or but little beyond them-------------------------- 4
3. Dorsal plates on fourth segment widely separated, not fused at base, each lunate with indented inner margin------------ gracilis (p. 420)
   Dorsal plates on fourth segment fused at base, each semielliptical, with straight inner margin------------------------ fuscus (p. 421)
4. Posterior processes of genital segment conical, smooth, inclined outward, and quite slender-------------------------- carchariae (p. 422)
   Posterior processes of genital segment flattened laterally, thick, fringed with spines, inclined inward-------- crassus, new species (p. 423)

MALES

1. Genital segment with small triangular processes at its posterior corners; fifth legs visible dorsally---------------------- glaber (p. 419)
   Genital segment with smoothly rounded posterior corners, no processes; no fifth legs visible dorsally--------------------------------- 2
2. Genital segment elliptical, widest at center, one-third longer than wide, with convex lateral margins----------------- gracilis (p. 420)
   Genital segment oblong, widest at anterior end, twice as long as wide; with straight lateral margins-------- crassus, new species (p. 423)

ALEBION GLABER Wilson

FIGURE 263

Alebion glaber WILSON, Proc. U. S. Nat. Mus., vol. 31, p. 708, pl. 19, 1907.

Occurrence.—Found on the outside surface of the smooth dogfish, the spiny dogfish, the sand shark, the barn-door skate, the brown shark, and the bonito, all captured near Woods Hole.

Distribution.—Not found outside the present area.

Color.—Body a uniform horn gray, semitransparent, and without pigment marks.

Female.—Carapace orbicular, as wide as long, the median lobe squarely truncated, or slightly concave. Fourth segment nearly as wide as genital segment, its dorsal plates small, orbicular, and separated by a wide posterior sinus. Genital segment half the width of the carapace, longer than wide, with nearly parallel sides and a concave posterior margin; no leg rudiments visible. Abdomen 2-segmented, segments equal in length, the basal one the wider. Exopods of first three pairs of legs with small horny claws; fourth legs 1-segmented, not visible dorsally; two corrugated chitin ridges in place of a furca. Total length, 10–12 mm.

Male.—Carapace longer than wide, widest posteriorly; fourth segment long and narrow, less than half the width of the genital segment and without dorsal plates. Genital segment narrow, spindle-shaped, and squarely truncated posteriorly, with small spinelike lobes at the corners; two pairs of leg rudiments present. Abdomen 2-segmented, segments equal in length, the terminal one slightly wider. Total length, 7–7.75 mm.

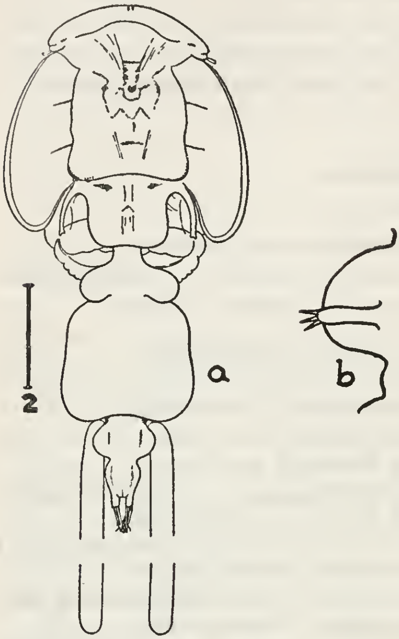

FIGURE 263.—*Alebion glaber: a,* Female, dorsal (drawn by A. H. Baldwin, September 21, 1887) ; *b,* female, fourth leg

Remarks.—The absence of posterior processes on the genital segment is the best means of identification for this species. It is fairly common around Woods Hole but has not been found anywhere outside of this area.

ALEBION GRACILIS Wilson

FIGURE 264

Alebion gracilis WILSON, Proc. U. S. Nat. Mus., vol. 31, p. 704, pl. 18, 1907.

Occurrence.—Found on the outside surface of the common dogfish, the spiny dogfish, the sand shark, the dusky shark, the pollack, and the bonito.

Distribution.—Outside the present area a single lot of specimens has been sent to the United States National Museum from the Laysan Islands in the Pacific Ocean.

Color.—Body a transparent cartilage gray, without pigment markings.

Female.—Carapace elliptical, longer than wide, the median lobe squarely truncated; fourth segment nearly as wide as the genital segment and half as long; dorsal plates strongly curved, the convex sides outward, the distal ends squarely truncated. Genital segment half the width of the carapace, widest at the center, each posterior corner a stout conical process reaching beyond the tip of the abdomen and sparsely set with spines. Abdomen 2-segmented, basal segment with a long process at each posterior corner; horny claws on the first three exopods larger than in *glaber*. Total length, 9–10 mm.

Male.—Carapace orbicular, a little wider than long; fourth segment as wide as the genital segment; rudiments of dorsal plates projecting laterally. Genital segment small and elliptical, widest at the center with convex lateral margins, and with no spines or processes at the posterior corners; a pair of leg rudiments on the ventral surface near the lateral margins. Abdomen 2-segmented, the segments about equal. Total length, 5–6 mm.

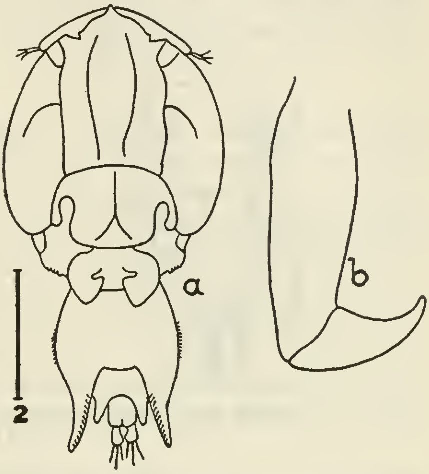

FIGURE 264.—*Alebion gracilis: a,* Female, dorsal; *b,* maxilliped

Remarks.—This species can be recognized by the strongly curved dorsal plates of the fourth segment in the female and the smoothly rounded genital segment of the male. It is fairly common as indicated by the number of hosts.

ALEBION FUSCUS Wilson

FIGURE 265

Alebion fuscus WILSON, Proc. U. S. Nat. Mus., vol. 59, p. 2, pls. 1, 2, 1921.

Occurrence.—Found on the outside surface and fins of the dusky shark at Menemsha Bight, Marthas Vineyard.

Distribution.—Not found outside the present area.

Color.—Body a rich reddish brown, deepening into black in preservatives; eye dark brick red; egg strings dark brownish gray.

Female.—Carapace elliptical, longer than wide; median lobe squarely truncated posteriorly and armed at each posterior corner with three large spines; fourth segment as wide as genital segment, but only a fourth as long, dorsal plates semielliptical, outer margins strongly convex, inner margins straight, separated by a deep narrow sinus. Genital segment half the width of the carapace, with convex lateral margins armed with a row of long spines, and slender posterior processes, laterally compressed and fringed with spines. Abdomen 2-segmented, basal segment considerably the larger, with posterior precesses; caudal rami four times as long as wide. Total length, 8–10 mm.

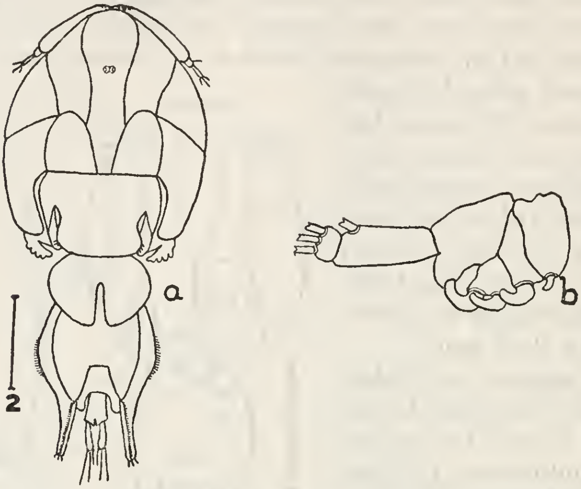

Figure 265.—*Alebion fuscus: a,* Female, dorsal; *b,* female, third leg

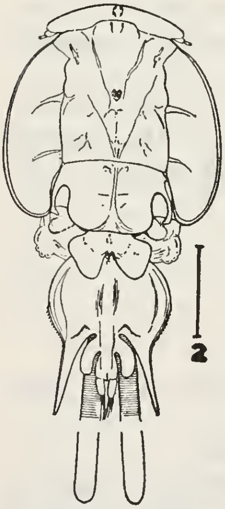

Figure 266.—*Alebion carchariae:* Female, dorsal (drawn by A. H. Baldwin, September, 1887)

Male.—Unknown.

Remarks.—This species can be distinguished by its darker color and by the shape and size of the dorsal plates on the fourth segment.

ALEBION CARCHARIAE Krøyer

Figure 266

Alebion carchariae Krøyer, Naturh. Tidsskrift, ser. 3, vol. 2, p. 165, pl. 12, 1863.—Wilson, Proc. U. S. Nat. Mus., vol. 31, p. 704, 1907.

Occurrence.—Found on the outside surface of the common dogfish and the dusky shark at Woods Hole, August, 1885.

Distribution.—Northern Atlantic (Krøyer); Cape Verde Islands (Brady, Brian); Indian Ocean (Bassett-Smith).

Color.—Body a uniform cartilage gray and fairly transparent.

Female.—Carapace orbicular, as wide as long, the median lobe squarely truncated posteriorly; fourth segment two-thirds as wide as the genital segment, dorsal plates subtriangular, separated by a sinus of medium width. Genital segment orbicular, its lateral margins very convex and dentate, its posterior corners produced into slender conical processes, reaching beyond the tips of the caudal rami, and without spines except at the tip. Abdomen 2-segmented, basal segment lunate, produced laterally into curved lobes, each larger than the segment itself; caudal rami twice as long as wide. Total length, 8–9 mm.

Male.—Unknown.

Remarks.—Krøyer did not have a male of this species, as he claimed, but a female without egg strings, as can be seen from Baldwin's figure here given. The two specimens described by Bassett-Smith as the female of Krøyer's male are evidently an entirely different species, as shown by the shape and proportions of the genital and first abdominal segments, and the new specific name *maculatus* may be suggested for it in allusion to the six bright red pigment spots on the dorsal surface of the genital segment, which are found in no other species. Although discovered and figured by Rathbun in 1885, this is the first time the species has been reported from our American shores.

ALEBION CRASSUS, new species

PLATE 26

Occurrence.—Two females and a male were taken from the outside of the hammerhead shark (*Sphyrna zygaena*) at Woods Hole, August 1, 1913. The best female has been made the holotype with U.S.N.M. No. 56614.

Color.—Body light yellowish brown, becoming darker in the thicker portions over the digestive and reproductive organs; eye red.

Female.—Carapace orbicular, wider than long; frontal plates narrow with a circular median sinus; lateral lobes broad, curved strongly inward at their tips, and reaching considerably behind the median lobe. On the inner margin of each of these lateral lobes is a double flap or transparent border, one part dorsal and one part ventral. To the dorsal flap, near the tip of the lobe, is attached a small tab turned backward and lying on the dorsal surface of the lobe. The median lobe of the carapace is broad and slightly concave on its posterior margin, with two or three small spines at each corner. Grooves separating the areas of the carapace arranged like the letter H as in other species, the median area exceptionally broad. Eye so small as to be detected only by transmitted light.

Fourth segment a little more than half as wide as the genital segment, its dorsal plates orbicular, extending well onto the genital segment, and separated by a wide posterior sinus. Genital segment five-eighths as wide as carapace, widest behind the center, where its lateral margins are convex and are armed with a fringe of stout spines. Posterior processes widened and flattened, the inner edges turned up dorsally and fringed with short spines, the tips with a cluster of larger spines. The center of the segment is raised dorsally above the rest, and its posterior corners are rounded and armed with a row of spines.

Abdomen 2-segmented, the basal segment wider than the terminal, with broad lateral flaps which are turned down ventrally, causing the lateral margins of the segment to appear straight in dorsal view. Terminal segment with a semicircular distal end, to the margin of which the caudal rami are attached; these are broadly lamellar, a little longer than wide, each tipped with four short setae of about the same length.

Terminal segment of first antenna minute and scarcely visible; second antenna with very stout terminal claws, strongly curved. Terminal claw of maxillipeds with two stout teeth on its inner margin; horny process on first exopod large, on second and third exopods rather small. Spermatophores elongate and cylindrical, lying flat upon the ventral surface of the genital segment, with a small curved knob at the free end. Total length, 14 mm.; width of carapace, 8 mm.

Male.—Carapace similar to that of female, wider than long, its lateral lobes reaching behind the posterior margin of the median lobe. As in the female, the inner margins of these lateral lobes have a double transparent flap, the dorsal one with an accessory tab turned backward near the end of the lobe. Fourth segment longer than in the female, its dorsal plates rudimentary, in the form of rounded projections from the sides of the segment. Genital segment twice as long as wide, widest near the anterior end, with straight lateral margins and rounded posterior corners. No leg rudiments appear dorsally, but one pair can be seen ventrally near the posterior corners. Abdomen 2-segmented, the basal segment narrower and shorter than the terminal. Caudal rami large flattened laminae longer than wide, each with four apical setae, the second inner one the longest, the outer one the shortest. Total length, 11 mm.

Remarks.—This is the largest species of the genus and may be recognized by its size and by the peculiar inner margins of the lateral lobes of the carapace with their accessory tabs, which show up distinctly in dorsal view.

Family PANDARIDAE

Genus PERISSOPUS Steenstrup and Lütken, 1861

Female.—Head fused with first segment, carapace wider than long; second, third, and fourth segments free, each with a pair of dorsal plates, those on the second segment lateral and oblique, on the third segment median and horizontal, on the fourth segment extending across the body. Genital segment larger than carapace; abdomen entirely concealed, 1-segmented, attached to ventral surface of genital segment. First four pairs of legs biramose, rami of first and second pairs 2-segmented, of third and fourth pairs 1-segmented; fifth legs obsolete.

Male.—Carapace longer than wide; second segment with small lateral plates, third and fourth segments without dorsal plates; genital segment much smaller than carapace, quadrilateral, the fifth legs prominent on the lateral margins near the posterior corners. Abdomen large, 1-segmented, entirely visible behind the genital segment. Rami of first four pairs of legs 2-segmented, segments of fourth pair more or less fused; maxilliped with stout claw shutting against a pair of corrugated knobs. A single species in this area.

PERISSOPUS COMMUNIS Rathbun

FIGURE 267

Perissopus communis RATHBUN, Proc. U. S. Nat. Mus., vol. 10, p. 560, pls. 29, 30, 1887.—WILSON, Proc. U. S. Nat. Mus., vol. 33, p. 354, pls. 17, 18, 1907.

Occurrence.—Found on the gills and fins of the dusky shark, the brown shark, and the smooth dogfish, all captured at or near Woods Hole.

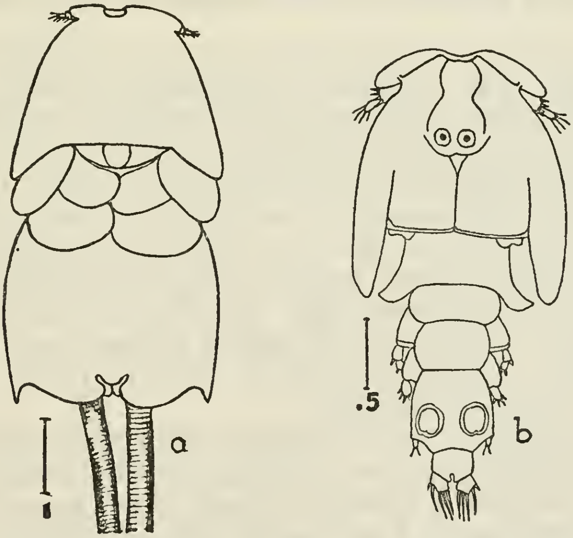

FIGURE 267.—*Perissopus communis: a,* Female, dorsal; *b,* male, dorsal

Distribution.—Not found outside the present area except as mentioned below.

Color.—Body a light yellowish white, without pigment markings.

Female.—Carapace semielliptical, widest at its posterior angles; dorsal plates of second segment inclined at an angle of 45° and widely separated, the space between their bases filled with a small central plate; plates of third segment smaller than those of second segment, and nearly in the same transverse line; the plates of the fourth segment circular, meeting on the midline; plates of second and fourth segments with dentate margins, of third segment smooth. Total length, 3.75–4.25 mm.

Male.—Carapace narrowed anteriorly, squarely truncated posteriorly between the lobes, the latter reaching the posterior margin of the second segment; free segments decreasing regularly in width backward, the fourth segment as wide as the genital segment. Abdomen half as wide as the genital segment; caudal rami short and triangular, each with four apical setae. Total length, 2.75–3.25 mm.

Remarks.—This species has been found in a single instance by Brian in the Mediterranean off the coast of Mauretania upon the shark *Mustelus asterias.* It can be recognized by a large hemispherical knob on the ventral surface of the carapace on either side, near the margin and opposite the pad of the maxilliped. The third rami also are as distinctly segmented as the other pairs.

Genus ECHTHROGALEUS Steenstrup and Lütken, 1861

Female.—Head fused with first segment, second, third, and fourth segments free, each with a pair of dorsal plates; those of second segment lateral, of third segment median, both pairs rudimentary and very small; plates of fourth segment large, covering more than half of the genital segment and extending across the body. Genital segment as large as the carapace or larger, with a deep posterior sinus and long rounded lobes. Abdomen 1-segmented, attached to ventral surface of genital segment, usually partly visible; caudal rami large and armed with nonplumose setae. First four pairs of legs biramose, rami of first pair 2-segmented; exopods of second and third pairs 3-segmented, endopods 2-segmented; rami of fourth legs large lamellae, imperfectly segmented.

Male.—A *Nogaus* form, the carapace usually wider than long, with accessory lobes on the posterior margin inside the lateral lobes; second, third, and fourth segments free, each with a pair of small dorsal plates, those on the fourth segment scarcely overlapping the anterior margin of the genital segment. The latter very much smaller than the carapace, more or less quadrilateral with rudiments of fifth legs near the posterior corners. Abdomen entirely visible in dorsal view, and 2-segmented; caudal rami each nearly as large as the anal segment and armed with four plumose setae.

KEY TO THE SPECIES (FEMALES)

1. Body more than twice as long as wide; carapace smaller than genital segment; plates of fourth segment with circular dots -------- coleoptratus (p. 427)
   Body less than twice as long as wide; carapace as large as genital segment; plates of fourth segment without dots -------- 2
2. Dorsal plates of fourth segment with denticulate margins and spines at their anterior corners -------- denticulatus (p. 428)
   Dorsal plates of fourth segment with smooth margins and without spines at their anterior corners -------- torpedinis (p. 429)

ECHTHROGALEUS COLEOPTRATUS (Guérin)

Plate 27

Dinematura coleoptrata Guérin, Régne animal de Cuvier, pl. 35, fig. 6, 1837.
Echthrogaleus coleoptratus Wilson, Proc. U. S. Nat. Mus., vol. 33, p. 367, pl. 19, 1907.

Occurrence.—Found on the skin and fins of the sharp-nosed mackerel shark (*Isurus tigris*) and the brown shark (*Carcharhinus milberti*) at Woods Hole.

Distribution.—Indian Ocean (Johnston, Milne Edwards); English seas (Baird, White, Stebbing, Scott); North Atlantic (Steenstrup and Lütken); Bohuslän (Olsson); Faroe Islands (Hansen); coast of Italy (Brian); South Africa (Stebbing); Woods Hole (Smith, Rathbun, Wilson).

Color.—Body a dull grayish yellow, lighter on the ventral, darker on the dorsal surface; the center of the carapace and the entire dorsal plates of the fourth segment chestnut-brown; eye brownish red.

Female.—Body more than twice as long as wide; carapace orbicular, as wide as long, much shorter and a little narrower than the genital segment; dorsal plates of the second segment widely separated, lateral and oblique; those of the third segment median, fused across the midline, and scarcely reaching the posterior margin of the segment; those of the fourth segment trapezoidal, reaching the center of the genital segment and showing a pattern of transparent circular dots. Genital segment elliptical, longer than wide, with a deep posterior sinus; rudiments of fifth legs on under surface of posterior lobes and invisible in dorsal view. Abdomen wider than long, invisible dorsally, or partly visible; caudal rami laminate, each with six spines. Total length, 12–14 mm.

Male.—Carapace suborbicular, a little wider than long, with smoothly rounded margins; frontal plates of moderate width and strongly arched; posterior lobes narrow and curved inward at their tips like those of the female; accessory lobes small, separated from the lateral lobes by the width of the transparent margin of the latter; eyes almost invisible. Second segment with lateral lobes extending diagonally outward and backward, their tips concealed beneath the posterior lobes of the carapace. These lateral lobes are squarely truncated, and each carries a small spine at its anterior corner. Lateral lobes of the third and fourth segments evenly rounded, the fourth ones short and giving the dorsal surface of the segment a lunate shape, slightly overlapping the anterior margin of the genital segment. The latter is barrel-shaped, with somewhat convex sides and minute knobs at the posterior corners, with leg rudiments just in front of the knobs. Abdomen less than half the width of the genital segment, made up of two segments separated by a deep groove, the basal segment shorter and narrower than the distal. Caudal rami broad and laminate, each tipped with four stout plumose setae.

Antennae and mouth parts like those of the female, the second antenna larger and armed with a long spine on the ventral surface of the terminal segment. Basal segment of maxillipeds with two large corrugated knobs and a larger hollow knob or cup, into which the tip of the end claw shuts. Swimming legs as in the female, except the fourth pair, whose exopods are 3-segmented while the endopods are 2-segmented. Total length, 6.25 mm. Carapace, 3.6 mm. long and 4 mm. wide.

Remarks.—This is the first description of the male of the species, and it is found to be similar to those described for other species by Heller, Thomson, and Olsson. But none of these authors noted any accessory lobes on the posterior margin of the carapace, and the present male shows a much greater relative width of the third and fourth segments. The two males were found in company with females on the gills of an exceptionally large brown shark, *Carcharhinus milberti*, captured in the pound nets at Menemsha Bight, Marthas Vineyard, July 15, 1923. These males differ from those of other species of the genus heretofore described in having the exopod of the fourth legs 3-segmented instead of 2-segmented.

ECHTHROGALEUS DENTICULATUS Smith

FIGURE 268

Echthrogaleus denticulatus SMITH, Report upon the invertebrate animals of Vineyard Sound and adjacent waters, p. 282, 1874.—WILSON, Proc. U. S. Nat. Mus., vol. 33, p. 369, pl. 20, 1907.

Occurrence.—A single specimen was taken from Atwood's shark, or the great white shark (*Carcharodon carcharias*), in Vineyard Sound by Prof. S. I. Smith.

Distribution.—Not found outside the present area.

Color.—The body of the preserved specimen is a uniform yellowish brown.

Female.—Carapace orbicular, wider than long, its posterior lobes reaching the dorsal plates of the fourth segment. Dorsal plates of second segment lateral and nearly concealed, of third segment median and fused, the posterior margin concave; of the fourth segment nearly as wide as carapace, covering two-thirds of the genital segment, with denticulate margins and a stout spine at each anterior corner. Genital segment elliptical, with wide posterior lobes bearing leg rudiments, and between them a median dorsal plate. Abdomen large and wedge-shaped; caudal rami oblong, each tipped with two or three small setae. Exopod of fourth legs distinctly 3-segmented, endopod fused into a single lamina, which is unarmed. Total length, 9 mm.

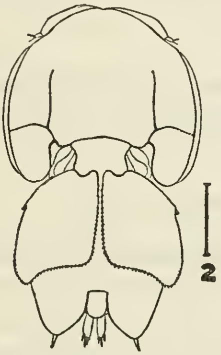

FIGURE 268.—*Echthrogaleus denticulatus:* Female, dorsal (drawn by Sidney I. Smith, 1873)

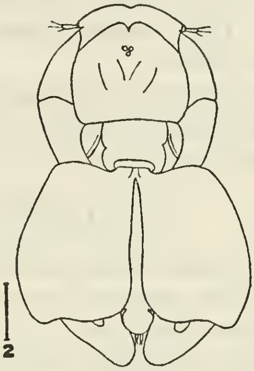

FIGURE 269.—*Echthrogaleus torpedinis:* Female, dorsal

Male.—Unknown.

Remarks.—This species can be identified by the denticulate margins of the fourth dorsal plates, and the spines at their anterior corners. The host is only rarely captured and this probably accounts for the paucity of material.

ECHTHROGALEUS TORPEDINIS Wilson

FIGURE 269

Echthrogaleus torpedinis WILSON, Proc. U. S. Nat. Mus., vol. 33, p. 371, pl. 21, 1907.

Occurrence.—Taken from the fins of the common torpedo (*Tetranarce occidentalis*) at Woods Hole and at Provincetown.

Distribution.—Not found outside the present area.

Color.—Body of preserved specimens a uniform dark cinnamon-brown.

Female.—Carapace orbicular, wider than long; second and third segments indistinctly separated dorsally; dorsal plates of second segment large, extending beneath the posterior lobes of the carapace, of the third segment with incurved tips, of the fourth segment large enough to cover all the genital segment except its posterior lobes, with smooth margins. Genital segment elliptical, wider than carapace, longer than wide, its posterior lobes turned inward and almost meeting at their tips. Abdomen subquadrangular; caudal rami large and broad, each armed with a few coarse spines. In the fourth legs each ramus is fused into a single lamina, the endopod unarmed. Total length, 13 mm.

Male.—Unknown.

Remarks.—The size of the dorsal plates on the fourth segment will identify this species, which thus far has not been found on any host except the torpedo.

Genus DINEMATURA Burmeister, 1833

Female.—Head fused with first segment, second, third, and fourth segments free, each with a pair of dorsal plates; fifth and genital segments fused with a pair of dorsal plates; a sixth segment distinctly separated from the genital segment in front of the abdomen, with a pair of dorsal plates and rudimentary legs. Abdomen 1-segmented, attached to the posterior end of this sixth segment. First four pairs of legs biramose, rami of first legs 2-segmented, of second and third legs 3-segmented, of fourth pair 1-segmented.

Male.—Carapace like that of female; dorsal plates of second segment lateral and small; no plates on third segment; those on fourth segment rudimentary; genital segment oblong, widest posteriorly; no sixth segment; no leg rudiments. Abdomen 2-segmented, segments subequal; caudal rami large, foliaceous, and armed with plumose setae. Both rami of fourth legs distinctly 2-segmented and armed with spines only.

KEY TO THE SPECIES

FEMALES

1. Carapace one-third entire length; dorsal plates of fourth segment much longer than wide, with rounded tips______________ **producta** (p. 431)
   Carapace one-half entire length; dorsal plates of fourth segment much wider than long, with concave posterior margin____ **latifolia** (p. 432)

MALES

1. Second and fourth segments without dorsal plates; distal abdominal segment longer than wide__________________________ **producta** (p. 431)
   Second and fourth segments with small dorsal plates; distal abdominal segment wider than long______________________ **latifolia** (p. 432)

DINEMATURA PRODUCTA (Müller)

Figure 270

Caligus productus Müller, Entomostraca, p. 132, pl. 21, figs. 3–4, 1785.
Dinematura producta Wilson, Proc. U. S. Nat. Mus., vol. 33, p. 380, pl. 23, 1907.—Brian, Monitore Zool. Ital., anno 22, no. 8, p. 197, 4 figs., 1911 (male).

Occurrence.—Taken from the fins of a " large shark " captured by the *Grampus* considerably south of Woods Hole.

Distribution.—British seas (Johnston, Baird, T. and A. Scott, Norman); Kattegat (Steenstrup and Lütken); coast of Norway (Jensen); Faroe Islands, Greenland (Hansen); Finmark (Krøyer); Gulf of Genoa (Brian); Denmark, Norway (Müller); Casco Bay, Me. (Wilson).

Color.—Body of preserved specimens a uniform light brown.

Female.—Carapace orbicular, deeply notched at the center of each lateral margin; second and third segments filling the space between the posterior lobes of the carapace, third segment with lateral-dorsal plates wider than those on second segment. Dorsal plates of fourth segment separated by a deep median sinus, their posterior ends evenly rounded. Genital segment twice as long as wide and half as wide as the carapace, its dorsal plates obliquely truncated; dorsal plates of sixth segment narrow and elongate, with rounded tips. Abdomen quadrangular; caudal rami foliaceous, with spines only; rami of fourth legs boot shaped, the heels turned outward; sixth legs 1-segmented, reaching the center of the caudal rami. Total length, 15–19 mm.

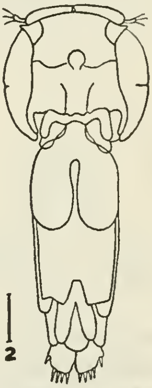

Figure 270.—*Dinematura producta:* Female, dorsal

Male.—Carapace orbicular, wider than long; second and third segments narrower and longer than in the female, both with dorsal plates; fourth segment without dorsal plates, the same width as the genital segment, contracted into a short narrow waist anteriorly. Genital segment elliptical, scarcely twice as long as wide, with evenly rounded posterior corners; no lobes, no dorsal plates, no leg rudiments, no sixth segment. Abdomen 2-segmented, the distal segment twice the length of the basal, the two the same width; caudal rami spatulate, each with four short setae. Total length, 12.5 mm.

Remarks.—This species was really obtained a little south of the present area, but as these southern sharks come into Vineyard Sound during summer, one of them is likely to be found carrying this parasite.

DINEMATURA LATIFOLIA Steenstrup and Lütken

FIGURE 271

Dinematura latifolia STEENSTRUP and LÜTKEN, Kong. Danske Vid. Selsk. Skrift., ser. 5, vol. 5, p. 378, pl. 8, fig. 16, 1861.—WILSON, Proc. U. S. Nat. Mus., vol. 33, p. 383, pls. 24, 25, 1907.

Occurrence.—Taken from the skin and fins of the mackerel shark (*Isurus punctatus*) and the great white shark (*Carcharodon carcharias*) at Menemsha Bight, Marthas Vineyard.

Distribution.—Northern Atlantic (Steenstrup and Lütken); Mediterranean (Heller, Carus); South Africa (Wahlberg); Adriatic (Valle); Island of Elba (Brian); Coxs Ledge, Mass. (M. Rathbun); English coast (Wilson).

Color.—Body yellowish green, considerably darker in the thicker parts of the body, the dorsal plates and thin margins a clear light yellow.

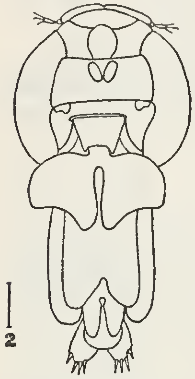

FIGURE 271.—*Dinematura latifolia:* Female, dorsal

Female.—Carapace twice as wide as long on the midline, its posterior lobes curved inward; second segment shorter than the third but wider, with a pair of large dorsal plates; third segment wedge-shaped and without dorsal plates; fourth segment with plates extending laterally beyond the margins of the genital segment, and posteriorly nearly to its center. Genital segment elongate, its length to its width as 11:7, its dorsal plates much narrower than the segment itself, with bluntly rounded tips. Dorsal plates of sixth segment separated by a narrow sinus; abdomen kidney-shaped, twice as wide as long; caudal rami one-half longer than wide, armed with spines only. Total length, 14–16 mm.

Male.—Carapace like that of the female, with very broad posterior lobes; second and fourth segments with dorsal plates, third segment without them. Genital segment oblong, enlarged posteriorly and then contracted suddenly to the base of the abdomen; no leg rudiments, no sixth segment. Abdomen 2-segmented, segments subequal; caudal rami foliaceous, as large as the anal segment, and armed with stout plumose setae. Total length, 8–8.5 mm.

Remarks.—This species can be recognized by the projecting lateral margins of the dorsal plates of the fourth segment and their diagonal posterior truncation in the female.

Genus PANDARUS Leach, 1816

Female.—Head fused with first segment, the carapace without grooves; posterior lobes short, the margin between them sinuate or toothed; second segment with lateral dorsal plates, sometimes fused across the midline; third segment with median plates, fused or separate; fourth and genital segments with fused plates, covering the full width of the body; sixth segment represented by a median lobe attached to the posterior sinus of the genital segment. Abdomen 2-segmented, hidden dorsally by the sixth segment lobe and ventrally by a short and wide plate; caudal rami in the form of dentate processes attached to the sides of the ventral plate at its base. Four pairs of biramose swimming legs, all the rami laminate and 2-segmented, but the segments more or less fused; no fifth or sixth leg rudiments.

Male.—The original type of the genus *Nogaus*; head fused with first segment; carapace broad, with convex sides, posterior lobes curved inward, the margin between them with a pair of secondary lobes; eyes usually visible. Second segment with lateral dorsal plates, third and fourth segments without them; genital segment moderately enlarged, with rudiments of fifth and sixth legs; no separate sixth segment. Abdomen 2-segmented, segments subequal; caudal rami foliaceous, each with three or four large plumose setae. Rami of first four pairs of legs distinctly 2-segmented.

KEY TO THE SPECIES

FEMALES

1. Dorsal plates of fourth segment reaching well beyond center of genital segment; sixth segment plate longer than wide-------------- 2
   Dorsal plates of fourth segment not reaching center of genital segment; sixth segment plate as wide as long or wider----------------- 3
2. A distinct median plate on second segment, between bases of lateral plates; third segment plates not fused---------- smithii (p. 434)
   No median plate on second segment; third segment plates fused across midline, with a shallow median sinus------------ cranchii (p. 435)
3. Second segment plates not reaching beyond tips of third segment plates; median sinus of latter short and narrow--------- bicolor (p. 436)
   Second segment plates reaching half their length beyond tips of third segment plates; sinus of latter wide and deep----- sinuatus (p. 437)

MALES

1. Carapace, including lobes, longer than wide; second, third, and fourth segments as wide as genital segment; abdomen wider than long-- smithii (p. 434)
   Carapace wider than long; fourth segment considerably narrower than genital segment; abdomen as long as wide------------------ 2
2. Length of carapace on midline one-third of body length; sixth leg rudiments larger than fifth, triangular, acuminate------ cranchii (p. 435)
   Length of carapace on midline nearly one-half of body length; sixth leg smaller than the fifth-- 3
3. Caudal rami one-half longer than wide, each with 4 apical setae, equidistant from one another----------------------------- bicolor (p. 436)
   Caudal rami scarcely longer than wide, inner seta not apical and far removed from other three-------------------------- sinuatus (p. 437)

PANDARUS SMITHII Rathbun

FIGURE 272

Pandarus smithii RATHBUN, Proc. U. S. Nat. Mus., vol. 9, p. 315, pls. 5, 7, 1886.—WILSON, Proc. U. S. Nat. Mus., vol. 33, p. 410, pls. 29, 30, 1907.

Occurrence.—Both sexes taken from the fins of the dusky shark, the sand shark, the great white shark, and the brown shark (*Carcharhinus milberti*) at Woods Hole and in the pound nets on Marthas Vineyard.

Distribution.—Hawaiian Islands; Gulf of Mexico; Laysan Islands, Pacific Ocean; Great South Bay, Long Island (Wilson).

Color.—Female a rich brownish black, the margins of the carapace and the dorsal plates, and a spot through the eye yellow or reddish. Male yellowish white and nearly transparent.

Female.—Carapace ovate, wider than long, with short posterior lobes, the margin between them with a row of coarse, bluntly rounded teeth. Lateral plates of second segment strongly divergent, twice as long as wide; between their bases an unpaired median plate, subtriangular in outline; dorsal plates of third segment circular, completely separated on the midline, and reaching little behind the center of the plates on the second segment. Plates of fourth segment enormous and covering three-fourths of the genital segment, with a short and narrow posterior sinus. Genital segment elliptical, with short and blunt posterior lobes; sixth segment plate ovate, one-third longer than wide, strongly narrowed anteriorly; caudal rami as long as sixth plate and divergent. Total length, 8–10 mm.

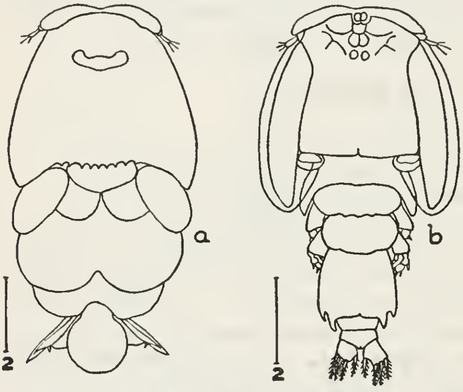

FIGURE 272.—*Pandarus smithii: a*, Female, dorsal; *b*, male, dorsal

Male.—Carapace, including posterior lobes, longer than wide, narrowed but little anteriorly; posterior lobes wide and blunt; accessory lobes wider than long. Second, third, and fourth segments increasing in length backward, but diminishing in width; fourth segment as wide as genital segment, with strongly convex lateral margins. Genital segment subquadrangular, wider than long; sixth leg rudiments larger than the fifth, but blunt and unarmed. Abdomen more than half as wide as the genital segment, much wider than long, basal segment shorter than terminal; caudal rami as wide as long, each with three apical setae and one on the inner margin, some distance from the apex. Total length, 7–8 mm.

Remarks.—The common sand shark is the chief host, but this species is likely to be found on any of the larger sharks. The complete separation of the dorsal plates of the third segment and the row of coarse, blunt teeth across the posterior margin of the carapace are the best identification characters.

PANDARUS CRANCHII Leach

FIGURE 273

Pandarus cranchii LEACH, Dictionnaire des sciences naturelles, vol. 14, p. 535. 1819.—WILSON, Proc. U. S. Nat. Mus., vol. 33, p. 403, pl. 28, 1907.

Occurrence.—Found on the fins of the dusky shark, the brown shark, and several other large sharks that were not identified.

Distribution.—Gulf of Guinea (Leach, Desmarest); North Atlantic (Steenstrup and Lütken); south of Long Island (Smith); Cape Verde Islands (Brian); Stations 2237 and 2422, *Albatross* (Rathbun); Great South Bay, Long Island (Wilson); between Papua and Japan (Brady).

Color.—Female a light brownish yellow, in the fully matured adult usually covered with brownish-black pigment over the entire dorsal surface, except the frontal plates, the margins of the carapace, dorsal plates, and genital segment, and in the center of the sixth segment plate. Male yellowish horn color and fairly transparent, with reddish eyes.

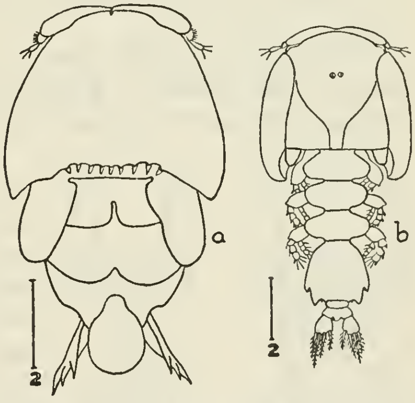

FIGURE 273.—*Pandarus cranchii: a,* Female, dorsal; *b,* male, dorsal (drawn by Emerton)

Female.—Carapace wider than long, the posterior margin between the lobes with a row of stout sharp spines. Dorsal plates of second segment large, reaching beyond the center of the plates on the fourth segment; plates on third segment short, with a shallow median sinus; plates on fourth segment covering three-fourths of the genital segment, or often more. Genital segment obovate, strongly narrowed posteriorly, with triangular posterior lobes; sixth segment plate longer than wide, contracted anteriorly; caudal rami longer than sixth plate and widely divergent. Total length, 6–8 mm.

Male.—Carapace wider than long, posterior lobes curved inward, accessory lobes longer than wide; second, third, and fourth segments about the same length and width, the fourth segment a trifle narrower than the genital segment, its lateral margins semicircles. Genital segment narrowed into a short waist anteriorly, with rudiments of both fifth and sixth legs, the latter much larger than the former and acutely pointed, but unarmed, the fifth pair with spines. Abdomen 2-segmented, segments the same length, the basal one enlarged through the middle; caudal rami as wide as long, each with three apical setae and one on the inner margin, removed from the others. Total length, 8–10 mm.

Remarks.—The female may be identified by the fact that the carapace is fully half the entire length; in the male the posterior lobes of the carapace curve inward and the accessory lobes are longer than wide.

PANDARUS BICOLOR Leach

FIGURE 274

Pandarus bicolor LEACH, Supplement Encyclopedia Britannica, vol. 1, p. 405, pl. 20, figs. 1, 2, 1816.—WILSON, Proc. U. S. Nat. Mus., vol. 33, p. 400, pl. 27, 1907.

Occurrence.—Found on the fins of the smooth dogfish at Woods Hole.

Distribution.—British seas (Leach, Baird, Scott); Bohuslän, Skager Rak (Olsson); Kattegat, North Sea (Krøyer); coast of Belgium (Beneden); Iceland (Hansen); Liguria (Brian).

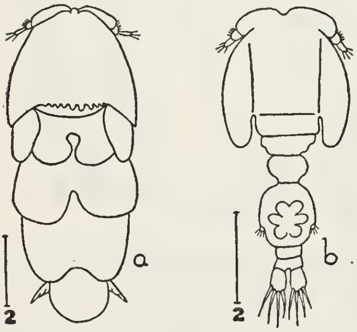

FIGURE 274.—*Pandarus bicolor: a,* Female, dorsal; *b,* male, dorsal (after T. Scott)

Color.—Female a creamy yellow, the dorsal surface of the carapace, the center of the dorsal plates of the second, third, and fourth segments, and two large spots connected across the midline in the posterior part of the genital segment an opaque chocolate brown, becoming black in preservatives. A Y-shaped spot through the eyes and extending backward along the midline is yellow and transparent. The male is light yellow and transparent.

Female.—Carapace one-third the entire length, widest posteriorly, the margin between the posterior lobes deeply sinuate. Dorsal plates of second segment not reaching beyond tips of plates on third segment; those on fourth segment covering only half the genital segment, with a broad median sinus. Genital segment elliptical, with broadly rounded posterior lobes; sixth segment plate more than half the width of genital segment, circular, as wide as long; caudal rami much shorter than the sixth segment plate, and widely divergent. Total length, 8–9 mm.

Male.—Carapace orbicular, as wide as long; posterior lobes wide, straight, and bluntly rounded; no accessory lobes; no lateral plates on second, third, or fourth segments. Fourth segment narrower than genital segment, contracted into a short waist posteriorly. Genital segment elliptical, longer than wide, rudiments of sixth legs smaller than those of fifth pair, the former unarmed, the latter armed with setae. Abdomen 2-segmented, segments equal; caudal rami each with four apical setae, all equidistant from one another. Total length, 6 mm.

Remarks.—The female can be recognized by the wide circular sixth segment plate and the short triangular caudal rami, the male by the absence of accessory lobes on the posterior margin of the carapace and of lateral dorsal plates on the second segment.

PANDARUS SINUATUS Say

FIGURE 275

Pandarus sinuatus SAY, Journ. Acad. Nat. Sci. Philadelphia, vol. 1, p. 436, 1818.—WILSON, Proc. U. S. Nat. Mus., vol. 33, p. 417, pls. 32, 33, 1907.

Occurrence.—Found in abundance on the fins of the common sand shark, the great white shark, the smooth dogfish, the dusky shark, the mackerel shark, the brown shark, and once on the menhaden.

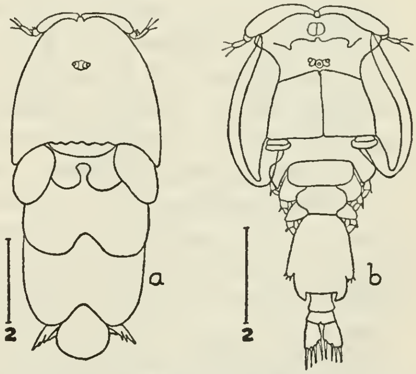

FIGURE 275.—*Pandarus sinuatus: a,* Female, dorsal; *b,* male, dorsal

Distribution.—Woods Hole area (S. I. Smith, R. Rathbun, M. J. Rathbun, McClendon, Wilson); Beaufort, N. C., Great South Bay, Long Island (Wilson).

Color.—Female yellow or yellowish white, with a wide curved band on each side of the carapace and a large spot in the center of the dorsal plates of the fourth segment brown or black. In mature females the oviducts give the genital segment a grayish or brownish tinge. Male yellowish and transparent, without the pigment markings.

Female.—Carapace less than half the entire length, with a sinuate margin between the posterior lobes; dorsal plates of the second segment broadly elliptical, divergent, reaching the center of the plates on the fourth segment. Plates of the third segment circular and separated by a deep median sinus, much enlarged at its base. Plates of fourth segment about as wide as the genital segment and covering the anterior third of the latter, with a wide and shallow median sinus. Genital segment elliptical, its posterior lobes broad and evenly rounded; sixth segment plate as wide as long, narrowed anteriorly; caudal rami much shorter than the sixth segment plate, widely divergent, and acutely pointed. Total length, 7–8 mm.

Male.—Carapace wider than long, its posterior lobes broadly triangular and slightly curved, accessory lobes very short, twice as wide as long. Second, third, and fourth segments about the same length, but diminishing rapidly in width, the fourth segment one-fourth narrower than the genital segment, with strongly convex lateral margins. Genital segment elliptical, one-third longer than wide; rudiments of fifth and sixth legs the same size and bluntly rounded, the sixth pair unarmed. Abdomen longer than wide, 2-segmented; caudal rami foliaceous, each with three apical setae, and one on the inner margin removed from the others. Total length, 7–7.5 mm.

Remarks.—This is by far the most common species of the genus in the area, and the sand shark is its usual host. The female can be identified by the large circular sinus between the plates of the third segment, and the male by the size and shape of the rudiments of the fifth and sixth legs.

Genus NESIPPUS Heller, 1865

Female.—Head fused with first segment, carapace transversely elliptical, much wider than long; second and third segments fused, with a single pair of dorsal plates, fourth segment free, with a pair of small plates. Genital segment elliptical, considerably enlarged, much longer than wide, with an evenly rounded outline and no posterior lobes or leg rudiments. Abdomen 1-segmented, attached to the ventral surface of the genital segment and invisible in dorsal view; caudal rami large and foliaceous. First four pairs of legs biramose, rami of first three pairs 2-segmented, of fourth pair 1-segmented; egg strings much longer than the entire body.

Male.—Carapace longer than wide, with posterior but without accessory lobes; second, third, and fourth segments all distinct, about the same length but diminishing in width, the fourth segment wider than the genital segment, all three segments without dorsal plates. Genital segment more or less angular, without lobes or leg rudiments; abdomen small, 1- or 2-segmented, wider than long; caudal rami small but armed with long plumose setae. One species within the present area.

NESIPPUS ALATUS Wilson

Figure 276

Nesippus alatus Wilson, Proc. U. S. Nat. Mus., vol. 33, p. 426, pls. 34, 35, 1907.

Occurrence.—Found in the throat of the common sand shark, the thresher shark, the great white shark, the dusky shark, the smooth dogfish, and the brown shark. Males are not only found on these sharks with the females but also on the outside surface of the flounder and killifish.

Distribution.—Found outside the present area only at Beaufort, N. C., in the throat of the sharp-nosed shark (*Scoliodon terraenovae*), the hammerhead shark (*Sphyrna zygaena*), and the bonnethead shark (*Reniceps tiburo*).

Color.—Body a uniform light yellowish white and fairly transparent, the coiled oviducts in the genital segment darker yellow and opaque; egg strings almost pure white, turning grayish brown with development.

Female.—Frontal region strongly narrowed and separated from the rest of the carapace; frontal plates very prominent; posterior lobes short and broad. Dorsal plates on fused second and third segments with angular corners; plates on fourth segment with a broad and shallow sinus. Caudal rami each as large as the abdomen, with four apical setae, equidistant from one another; maxillipeds with a stout, flattened terminal claw. Total length, 6.5–7.5 mm.

Male.—Carapace indistinctly grooved; posterior lobes narrow, each with a stout spine inside its base on the posterior margin of the carapace. Genital segment strongly narrowed at its anterior end, with concave posterior corners; basal segment of abdomen hardly visible in dorsal view; caudal rami each with three apical setae and one on the inner margin removed from the others. Total length, 4–5 mm.

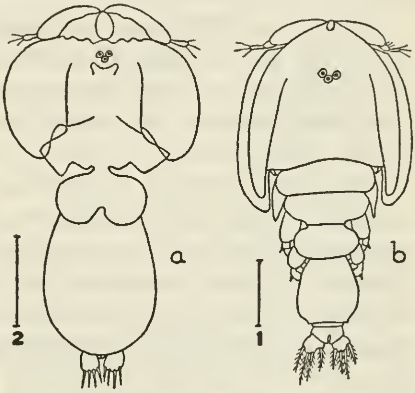

FIGURE 276.—*Nesippus alatus: a,* Female, dorsal; *b,* male, dorsal

Remarks.—This is the only copepod likely to be found inside the throat of a shark; the female may be identified by the fusion of the second and third segments, with a single pair of dorsal plates; the male lacks the accessory lobes on the posterior margin of the carapace and the fifth and sixth leg rudiments.

Genus PARAPANDARUS Wilson, 1924

Female.—Head fused with first segment; carapace narrowed anteriorly, cephalic area clearly differentiated; no posterior lobes; second, third, and fourth segments each with a pair of dorso-lateral plates. Fourth legs visible behind the plates on the fourth segment; genital segment with straight sides and no posterior lobes. Dorsal plate of sixth segment half as wide as genital segment, narrowed anteriorly, circular posteriorly; ventral abdominal plate much larger than the sixth segment plate. Abdomen 1-segmented, with modified caudal rami; first 3 pairs of legs with 2-segmented rami, fourth pair with 1-segmented rami; maxillipeds uncinate.

Male.—Carapace elliptical, posterior lobes wide, curved, bluntly rounded; no accessory lobes; second segment with a pair of posterolateral plates; third segment without plates or processes; fourth segment with a lateral knob on either side near the anterior margin, the rudiment of a dorsal plate. Genital segment oblong, with knoblike processes at the anterior corners and broadly rounded lobes at the posterior corners. Abdomen 2-segmented, segments equal; caudal rami foliaceous, each with four apical setae; rami of all four pairs of legs 2-segmented; maxillipeds with a stout terminal claw. A single species in this area.

Remarks.—This genus so closely resembles *Phyllophora* (Milne Edwards, 1840), changed to *Phyllothyreus* (Norman, 1903) because *Phyllophora* had been preoccupied, that the two may be identical. But Milne Edwards in his original description and figures, and later Carus (1885) made the rami of the first, second, and fourth legs 1-segmented. T. and A. Scott said that the first exopod was 1-segmented, the endopod 2-segmented, both rami of the second legs 2-segmented, and both rami of the third and fourth legs 1-segmented. Neither of these corresponds with what is here found, but as this is at least a new species the differences may be specific rather than generic. As the male of the type species (*cornutus*) has not yet been found, however, and as we have here a distinctive male, it will be better to wait before declaring the two genera identical.

PARAPANDARUS NODOSUS Wilson

FIGURE 277

Parapandarus nodosus WILSON, Proc. U. S. Nat. Mus., vol. 64, p. 8, pls. 2, 3, 1924.

Occurrence.—Found on the gills of the hammerhead shark (*Sphyrna zygaena*), the great blue shark (*Galeus glaucus*), and the brown shark (*Carcharhinus milberti*).

Distribution.—Not found outside the present area.

Color.—Body a uniform grayish white, without pigment markings, the thickened portions yellowish or brownish, the egg strings white.

Female.—Width of carapace across its posterior margin to its length as 8:5; posterior corners bluntly rounded, pointing outward; the width of each pair of dorsal plates on the second, third, and fourth segments about equal to that of the carapace; plates on fourth segment slightly overlapping the genital segment, their inner margins overlapping each other. Genital segment with straight sides and a wide posterior sinus, with leg rudiments projecting behind the posterior corners. Abdomen 1-segmented, covered ventrally with a large circular plate and dorsally with a much smaller sixth segment plate; caudal rami modified like those of *Pandarus.* Total length, 12–14 mm.

Male.—Lateral margins of carapace quite convex, posterior margin straight; posterior lobes one-third the length of the carapace; lateral plates of second segment extending diagonally to the tips of the posterior lobes of the carapace; third segment transversely elliptical and evenly rounded; fourth segment narrowed into a short waist in front of the lateral knobs. Posterior lobes of the genital segment curved inward, without any leg rudiments; basal segment of abdomen narrower than terminal; caudal rami enormous, their inner margins overlapping, each with four rather small apical setae. Total length, 13–15 mm.

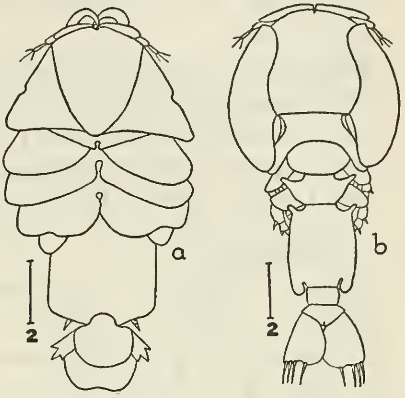

FIGURE 277.—*Parapandarus nodosus: a,* Female, dorsal; *b,* male, dorsal

Remarks.—The female of this genus may be recognized by the imbricated dorsal plates on the second, third, and fourth segments, the male by the lateral knobs on the fourth and genital segments. Unlike *Pandarus* it is found on the gills and not the fins of its shark host.

Family CECROPIDAE

Genus CECROPS Leach, 1816

Female.—Head fused with first segment, carapace with broad posterior lobes; second and third segments fused, the former with large lateral plates, the latter with small fused median plates; fourth segment with larger fused plates covering the anterior portion of the genital segment, with a narrow median sinus. Genital segment small, with fused dorsal plates extending beyond the tips of the caudal rami. Abdomen 1-segmented, as large as genital segment, its ventral surface produced laterally and anteriorly into lobes. Egg strings irregularly coiled and hidden between the dorsal plates of the genital segment and the ventral lobes of the abdomen. Rami of first three pairs of legs 2-segmented, of fourth pair 1-segmented; no leg rudiments on the genital segment.

Male.—A miniature female except as follows: Dorsal plates of fourth segment covering both genital segment and abdomen, the former without dorsal plates, the latter without ventral lobes, and twice as wide as long; legs enlarged but little, the rami 1-segmented. A single species in the area.

CECROPS LATREILLII Leach

Figure 278

Cecrops latreillii Leach, Supplement Encyclopaedia Britannica, vol. 1, p. 405, pl. 20, figs. 1–5, 1816.—Wilson, Proc. U. S. Nat. Mus., vol. 33, p. 468, pls. 38, 39, 1907.

Occurrence.—Found on the gills of the common sunfish captured in the pound nets on Marthas Vineyard.

Distribution.—British seas (Allman, Thompson, A. and T. Scott, Norman); New Zealand (Thomson); Mediterranean (Hope, Heller, Valle, Carus); Nizza (Risso); Norway (Olsson, Krøyer); northern Pacific, Gulf of Maine (Brian); coast of Belgium (Hoeven); off Gay Head (S. I. Smith, Rathbun).

Color.—Body a uniform yellowish white, the anterior ventral surface of the abdomen, and the edges of the dorsal plates of the genital segment with a few spots of light-brown pigment, very irregularly arranged; egg strings a deep orange-brown, the color increasing with development.

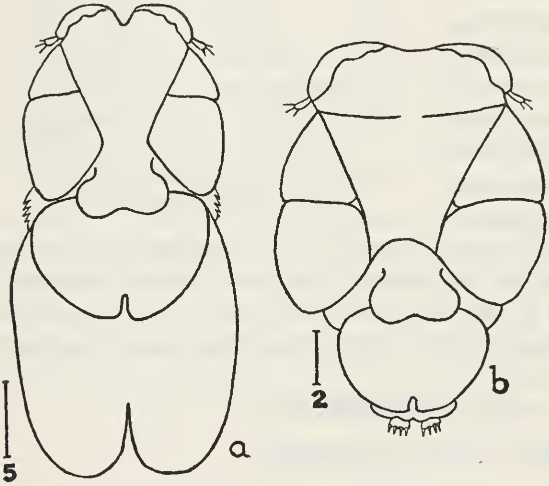

Figure 278.—*Cecrops latreillii: a,* Female, dorsal; *b,* male, dorsal

Female.—The division between the head and first segment is indicated by a notch on each lateral margin of the carapace, and by a dorsal groove across the lateral area. The broad lateral plates of the second segment are concealed beneath the posterior lobes of the carapace; the small median plates of the third segment overlap slightly those of the fourth segment, and the latter are triangular and reach the center of the plates covering the genital segment, being longest on the midline. The plates of the genital segment are nearly twice the length of the carapace, their margins are softened and rolled over ventrally, completely inclosing the abdomen, caudal rami, and egg strings; caudal rami small, orbicular, and armed with spines only. Total length, 25–30 mm.

Male.—Carapace and second and third segments similar to those of the female; dorsal plates of the fourth segment only half the width of the carapace and covering the whole of the genital segment and abdomen, except the caudal rami; combined they are one-half wider than long. Genital segment nearly twice as wide as long, much narrowed where it joins the fourth segment, and without dorsal plates. Abdomen half as wide, but much less than half as long, as the genital segment; caudal rami small, with small plumose setae. Total length, 14–17 mm.

Remarks.—This is one of the largest copepods, and in the present area it has been thus far confined to the sunfish for a host, but elsewhere it has been found upon several other kinds of fish.

Genus ORTHAGORISCICOLA Poche, 1902

Female.—Head fused with first segment, carapace wider than long, narrowed anteriorly, its lateral margins coarsely toothed, its dorsal surface sparsely covered with spines. Second and third segments distinct, with only rudiments of dorsal plates; fourth segment with dorsal plates covering half the genital segment, their margins serrate. Dorsal plates of genital segment much wider and longer than the carapace, overlapping each other on the midline, with serrate posterior margins. Abdomen concealed, with lateral lobes as in *Cecrops;* egg strings carried between these lobes and the dorsal plates. Rami of first two pairs of legs 2-segmented, of third and fourth pairs large 1-segmented laminae, without setae.

Male.—Carapace similar to that of female, but the margins are not toothed, and the dorsal surface has no spines; second and third segments forming a narrow waist, without dorsal plates; fourth segment plates a little narrower than the carapace, covering more than half the genital segment, their posterior margins serrate. Genital segment only two-thirds the size of the carapace, its dorsal plates narrower than those of the fourth segment, and serrate posteriorly. Abdomen small, quadrangular, showing through the posterior sinus of the genital segment plates. Rami of first three pairs of legs 2-segmented, of fourth pair 1-segmented, much enlarged laminae, armed only with spinules.

ORTHAGORISCICOLA MURICATA (Krøyer)

FIGURE 279

Laemargus muricatus KRØYER, Naturh. Tidsskrift, vol. 1, p. 487, pl. 5, figs. A–E, 1837.

Orthagoriscicola muricata WILSON, Proc. U. S. Nat. Mus., vol. 33, p. 473, pls. 40, 41, 1907.

Occurrence.—Found on the gills of the common sunfish and of the lookdown (*Selene vomer*) captured near Woods Hole.

Distribution.—European seas (Krøyer, Milne Edwards, Baird, Beneden); Mediterranean (Valle, Carus); British seas (A. and T. Scott); North Atlantic (Brian); Table Bay, South Africa (Stebbing); Woods Hole (R. Rathbun, McClendon, Wilson).

Color.—Body a uniform light yellow, the claws and chitin ribs of the carapace tinged with brown, often becoming quite dark.

Female.—Carapace trapezoidal; second and third segments with a knoblike projection on each lateral margin, representing the dorsal plates. Genital segment about the size of the carapace, one-half wider than long, its dorsal plates not curling over ventrally. Abdomen, including its lateral lobes, as wide as the genital segment, and about twice as long as that portion of the latter in front of the base of the abdomen. Egg strings, if straightened, twenty to thirty times the length of the body. Total length, 18–22 mm.

Male.—Second segment with lateral plate rudiments smaller than in the female, third segment without them, both segments very short. Plates of fourth segment circular, projecting forward at each anterior corner in a rounded lobe. Genital segment strongly depressed; abdomen small and weak, attached to the ventral surface of the genital segment, its posterior margin coinciding with that of the latter. Caudal rami three times as long as wide, each with four apical setae of about the same length. Total length, 10–15 mm.

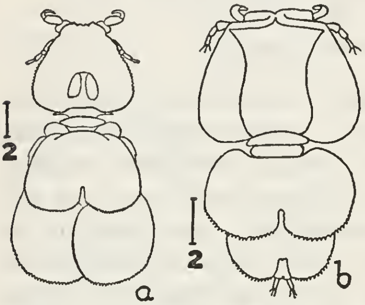

FIGURE 279.—*Orthagoriscicola muricata: a,* Female, dorsal (drawn by J. H. Emerton, 1873); *b,* male, dorsal

Remarks.—In the female the teeth and spines on the carapace, and the large size and toothed margins of the dorsal plates of the genital segment, will serve to identify the species. In the male the dentate margins of the dorsal plates on the fourth and genital segments are characteristics. The dorsal surface of this parasite is often loaded with algae, infusoria, hydrozöa, and even with the large-striped barnacle (*Conchoderma*), which is as large as the copepod itself.

Genus PHILORTHRAGORISCUS Horst, 1897

Female.—Head fused with first segment; carapace orbicular, with broad and rounded posterior lobes; second and third segments fused, with one pair of lateral plates, but no median ones; dorsal plates of fourth segment as wide as carapace, circular, almost entirely separated by the median sinus, with a spine at each anterior corner and denticulate margins; dorsal plates of genital segment nearly as large as carapace, with denticulate margins. Abdomen 1-segmented, attached to ventral surface of genital segment; caudal rami foliaceous, divergent. Rami of first three pairs of legs 2-segmented, of fourth pair 1-segmented; basal segments of second and third pairs forming wide aprons across the body; no fifth legs.

Male.—Carapace larger than rest of body, with large posterior lobes; second and third segments fused, with one pair of lateral plates, each with a spine at its anterior corner. Fourth segment with a pair of lateral plates that do not meet on the midline. Genital segment subquadrangular, its dorsal plates completely fused, with a shallow posterior sinus and a spine at each outer corner. Abdomen partly visible dorsally, 1-segmented; caudal rami longer than wide. A single species in the present area.

PHILORTHRAGORISCUS SERRATUS (Krøyer)

FIGURE 280

Dinematura serrata KRØYER, Naturh. Tidsskrift, ser. 3, vol. 2, p. 176, pl. 8, 1863.
Philorthragoriscus serratus WILSON, Proc. U. S. Nat. Mus., vol. 33, p. 479, pls. 42, 43, 1907.

Occurrence.—Found on the outside surface and fins of the common sunfish at Woods Hole, and in the Gulf of Maine.

Distribution.—Netherlands coast (Horst); English seas (Bassett-Smith, T. Scott); North Atlantic (Brian, Fowler); Vineyard Sound (Wilson).

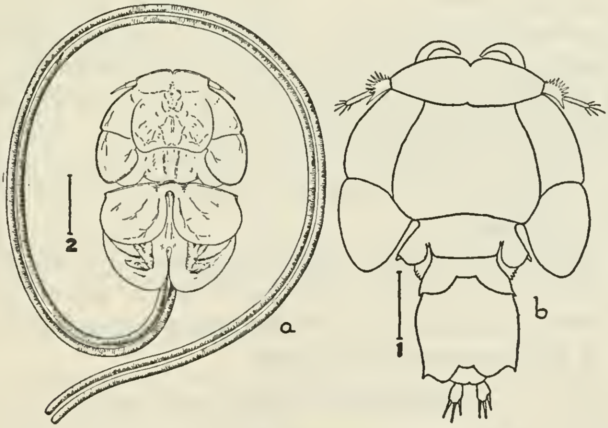

FIGURE 280.—*Philorthragoriscus serratus:* *a,* Female, dorsal (drawn by A. H. Baldwin, 1873); *b,* male, dorsal

Color.—Body a clear yellowish white, clouded with gray, sometimes the one color predominating, sometimes the other.

Female.—Carapace with acuminate teeth on the lateral and posterior margins, the lateral areas with a distinct groove between the head and first segment; fused second and third segments filling the space between the posterior lobes of the carapace; fourth segment much narrower. Terminal claw of second antenna with a small spine on its inner margin; terminal claw of maxillipeds shutting down between two blunt spines on the basal segment. Total length, 6–7.5 mm.

Male.—Carapace more than twice the width of the rest of the body, its lateral areas with a dividing groove between the head and first segment. Plates on the fourth segment smaller than those on the fused second-third segment; terminal claws of second antenna projecting well in front of the carapace. Basal exopod segment of first leg swollen and armed on its outer margin with stout spines curved distally, spine at the outer corner pectinate; outer margin of terminal segment lobed proximally, its spines pectinate. Total length, 4.5–5.5 mm.

Remarks.—Any sunfish captured in the present area will probably yield on its gills, fins, and outer skin specimens of the three genera last described. Sometimes 100 or more may be found on the same fish, whose slow movements and general lethargy seem well suited for parasitism.

Family ANTHOSOMIDAE

Genus ANTHOSOMA Leach, 1816

Female.—Body short and stout, head fused with first segment, carapace ovate, more than half the entire length; genital segment and abdomen covered dorsally by the fourth segment plates and ventrally by three pairs of overlapping foliaceous legs; fourth pair of legs obsolete, the first three pairs without rami. Abdomen 1-segmented; caudal rami narrow and elongated and unarmed; first antennae 6-segmented; second antennae 3-segmented, subchelate; maxillipeds uncinate.

Male.—No dorsal plates on fourth segment; first two pairs of legs with 1-segmented rami in notches on their inner margins; third legs without rami; fourth legs obsolete; other appendages as in the female. A single species in this area.

ANTHOSOMA CRASSUM (Abildgaard)

FIGURE 281

Caligus crassus ABILDGAARD, Skrivt. Naturh. Selsk., vol. 3, p. 46, pl. 5, 1794.
Anthosoma crassum WILSON, Proc. U. S. Nat. Mus., vol. 60, art. 5, p. 23, pl. 1, 1922.

Occurrence.—Found on the gills of the common sand shark, the porbeagle shark (*Isurus punctatus*), the sharp-nosed mackerel shark (*Isurus tigris*), and the jaw of the dusky shark, captured in the fish nets on Marthas Vineyard.

Distribution.—European seas (Abildgaard, Risso, Leach, Krøyer); British Isles (Baird, T. Scott); New Zealand (Thomson); Vineyard Sound (Gould, Rathbun, Wilson); California coast, Japan, Vancouver Island (U. S. National Museum).

Color.—Carapace dark brown in the center, paler and yellowish on the edges; dorsal plates and foliaceous legs grayish white, covered with minute transparent dots; free thorax, genital segment and abdomen dark yellowish brown.

Female.—Antennal area separated from rest of head by a dorsal groove; carapace projecting backward over the free thorax and overlapping the genital segment. Abdomen attached to the ventral surface of genital segment below and in front of the bases of the egg strings; caudal rami fleshy and longer than the abdomen. The tip of the terminal claw of the second antenna, when closed, interlocks with a stout peg on the ventral surface of the second segment, forming a sort of chela. Total length, 10–15 mm.

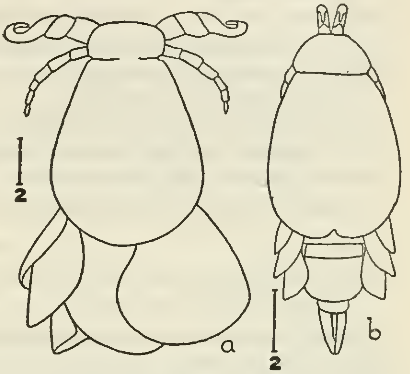

FIGURE 281.—*Anthosoma crassum: a,* Female, dorsal; *b,* male, dorsal

Male.—Carapace relatively longer and narrower than in the female; dorsal plates of fourth segment lacking so that the entire body behind the carapace is visible in dorsal view. Each leg of the first two pairs is notched on its inner margin, and carries in the notch a pair of 1-segmented rami, unarmed except the exopod of the second leg. Total length, 8–10 mm.

Remarks.—The favorite location of this shark parasite is in the throat, fastened to one of the gill arches, and it is likely to be found on almost any large shark in addition to those here mentioned.

Genus LERNANTHROPUS Blainville, 1822

Female.—Head fused with first segment, carapace margins turned down ventrally; free segments fused and covered with a single dorsal plate, prolonged backward over the genital segment and abdomen. Genital segment small, with convex sides; abdomen 1- or 2-segmented. Second antennae and maxillipeds prehensile and uncinate; first four pairs of legs biramose; rami of first and second pairs rudimentary and 1-segmented, of third pair lamellar and fused, projecting at right angles or diagonally from the ventral surface, of the fourth pair lamellar, separate, and extending backward; fifth legs, when present, uniramose and lamellar, often lacking.

Male.—Head fused with first segment, carapace with flat margins; free and genital segments fused, but without a dorsal plate. Abdomen 1-segmented and visible in dorsal view. Rami of first and second legs like those of the female, of third and fourth legs fused or separate, but always extending backward; fifth legs lacking.

KEY TO THE SPECIES

FEMALES

1. Dorsal plate with a deep median posterior sinus, not covering abdomen; fifth legs present---------- longipes, new species (p. 448)
   Dorsal plate without a posterior sinus, covering entire abdomen; no fifth legs---------- 2
2. Posterior portion of dorsal plate wider than anterior and folded around bases of fourth legs like a skirt---------- paenulatus (p. 449)
   Posterior portion of dorsal plate same width as anterior and not folded around fourth legs---------- 3
3. First antenna 8-segmented; fourth legs narrow, sharply pointed; third legs close together and parallel---------- pomatomi (p. 450)
   First antenna 3-segmented; fourth legs broad, bluntly pointed; third legs widely separated and divergent---------- brevzoortiae (p. 451)

MALES

1. Fourth legs biramose, endopod half as long as exopod, both rami acute---------- paenulatus (p. 449)
   Fourth legs uniramose and cydindrical---------- 2
2. Fourth legs stout, acute, and widely divergent; third legs also acute and one-third as long as fourth pair---------- pomatomi (p. 450)
   Fourth legs nearly parallel and blunt; third legs also blunt and half as long as fourth pair---------- brevoortiae (p. 451)

LERNANTHROPUS LONGIPES, new species

PLATE 28

Occurrence.—Four females with egg strings were found on the gills of a black drum (*Pogonias cromis*), caught within the present area and placed in the New York Aquarium. One has been selected as the species type, with U.S.N.M. No. 59788; the other three become paratypes, with U.S.N.M. No. 59789.

Color.—After remaining a short time in formalin the body was cinnamon-brown, somewhat lighter on the ventral surface and in the fourth legs.

Female.—General form elongate and narrow, owing chiefly to the great length of the fourth legs. Cephalothorax orbicular, as wide as long, with lateral flaps concealing the antennae and mouth parts, except in ventral view. Anterior portion of dorsal plate about as wide as long, the parts representing the second and third segments separated by distinct lateral invaginations and a much less distinct dorsal groove. Posterior portion of dorsal plate orbicular, as wide as long, with a median posterior sinus, one-fourth the length of the portion and enlarged at its base; posterior lobes on either side of this sinus bluntly rounded and very flat. The fifth segment, genital segment and abdomen are considerably fused, but are indicated by lateral sinuses and ventral grooves. The portion representing the fifth segment is as long as the other two combined and carries on its dorsal surface a pair of uniramose fifth legs. The portion representing the genital segment has strongly convex sides, to which are attached the red spherical spermatophores; the egg strings issue from its dorsal surface close behind the fifth legs. The caudal rami are leaf-shaped, as long as the abdomen and genital segment combined, and acutely pointed.

The first antennae are 6-segmented, the basal segment much thicker than the others, but all of them short and almost without setae. The second antennae are exceptionally stout, the terminal claw short, strongly curved and turned inward at right angles to the basal segment, the claws of the two antennae touching each other. The second maxilla is smaller than the second antenna or the maxilliped; its terminal claw is narrow and as long as the basal segment, with an accessory spine on its inner margin near the tip. The maxilliped is even stouter than the second antenna, and its basal segment has a corrugated swelling, against which the tip of the claw shuts down.

The first and second legs are biramose, the rami 1-segmented; the endopod of the first leg is conical and tipped with a short, nonplumose seta; the exopod is a flattened lamina with six short and blunt spines on the tip and outer margin. The third legs are exceptionally long and extend out side by side at right angles to the ventral surface. The fourth legs are comparatively slender but are more than half as long again as the whole body. The fifth legs are two-thirds as long as the body and conceal the genital segment and abdomen in dorsal view; the bases of these legs are just beneath the posterior margin of the dorsal plate. Total length, exclusive of fourth and fifth legs, 7.5–8 mm.; including fourth legs, 18.5–19 mm.

Male.—Unknown.

Remarks.—This species is easily identified by its large size and by the exceptional length of the fourth and fifth legs. The host is found in the southern part of the present area and ought to yield other specimens of the new species.

LERNANTHROPUS PAENULATUS Wilson

FIGURE 282

Lernanthropus paenulatus WILSON, Proc. U. S. Nat. Mus., vol. 60, p. 51, pl. 6, 7, 1922.

Occurrence.—Both sexes are found on the gills of the amber-jack (*Seriola lalandi*) at Woods Hole.

Color.—Body a uniform yellowish gray, turning to brown in preservatives.

Female.—Body elongate and narrow; carapace with large lateral flaps turned ventrally and hiding the antennae and mouth parts in lateral view. Anterior portion of dorsal plate twice as long as wide, posterior portion much widened at the posterior margin, and wrapped around the fourth legs leaving only the tips of the latter visible. Genital segment small with strongly convex sides; abdomen minute, 1-segmented; caudal rami narrow lanceolate, as long as the abdomen and genital segment combined, but not reaching the posterior margin of the dorsal plate. Fifth legs rudimentary stumps, concealed both dorsally and ventrally; first antennae 6-segmented, and sparsely setose. Total length, 9–9.5 mm. Length of egg strings, 16.75 mm.

Male.—Cephalothorax elliptical, narrowed anteriorly, second segment as wide as the head; third segment enlarged through the bases of the third legs, which extend outward at a wide angle with the body axis; fourth segment also widened through the bases of the fourth legs, which extend diagonally backward at an angle of 45°.

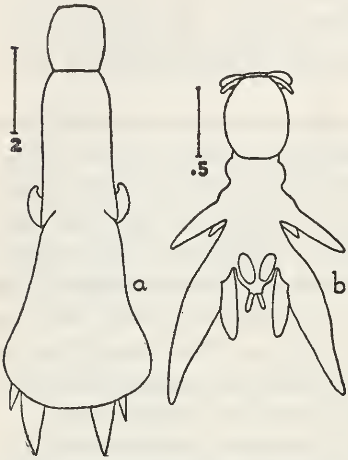

FIGURE 282.—*Lernanthropus paenulatus: a,* Female, dorsal; *b,* male, dorsal

Third and fourth legs biramose, the endopods much smaller than the exopods; caudal rami cylindrical, divergent, bluntly pointed and unarmed. Total length, 2.25–2.5 mm.

Remarks.—This species can be readily identified by the long skirt, or posterior portion of the dorsal plate, wrapped around the egg strings.

LERNANTHROPUS POMATOMI Rathbun

FIGURE 283

Lernanthropus pomatomi RATHBUN, Proc. U. S. Nat. Mus., vol. 10, p. 567, pls. 33–35, 1887.—WILSON, Proc. U. S. Nat. Mus., vol. 60, art. 5, p. 42, 1922.

Occurrence.—Found in abundance upon the gills of the common bluefish in the Woods Hole area.

Distribution.—Found on the same host at Beaufort, N. C. (Wilson).

Color.—Body of the living copepod bright red owing to the large quantity of blood diffused throughout the complex circulatory system; antennae and mouth parts horn color, egg strings brown. In preservatives the red becomes a light yellow and the appendages turn dark brown.

Female.—Cephalic segment narrowest across the frontal margin, which is slightly concave, and widest at the posterior margin, which is regularly rounded. Anterior portion of dorsal plate rectangular, with rounded corners, a half wider than long; posterior portion about the same width, but longer than wide, covering the abdomen, caudal rami, and bases of the egg strings and fourth legs. Genital segment subspherical; abdomen elongate; caudal rami as long as the abdomen and sharply pointed. Fourth legs biramose, cut nearly to the base, the endopods almost as long as the exopods. Total length, without fourth legs, 4–5 mm.; with fourth legs, 6–7 mm.

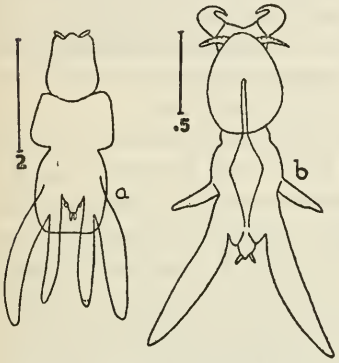

FIGURE 283.—*Lernanthropus pomatomi: a,* Female, dorsal; *b,* male, dorsal

Male.—Cephalic segment ovate, narrowed anteriorly, a little wider and nearly as long as the rest of the body; the latter widest through the bases of the third legs and tapered both anteriorly and posteriorly. Third and fourth legs uniramose, the third pair less than half the length of the fourth, both pairs bluntly pointed. Caudal rami short, stout, and bluntly rounded; posterior antennae exceptionally large and strong. Total length, 1.5–2 mm.

Remarks.—This species is apparently confined to the bluefish, and has not been found on any other host, and only once outside the present area, as recorded above. It is often present in considerable abundance.

LERNANTHROPUS BREVOORTIAE Rathbun

FIGURE 284

Lernanthropus brevoortiae RATHBUN, Proc. U. S. Nat. Mus., vol. 10, p. 563, pl. 31, 1887.—WILSON, Proc. U. S. Nat. Mus., vol. 60, art. 5, p. 43, pl. 8, 1922.

Occurrence.—Found on the gills of the menhaden and the hickory shad in the Woods Hole area.

Distribution.—Gills of menhaden at Beaufort, N. C. (Wilson).

Color.—Body light yellow and very transparent, more or less red in living specimens, but not so bright a red as in the preceding species; antennae and mouth parts horn color; egg strings dark brown.

Female.—Carapace oblong, narrowest at the anterior margin, which is convex; widest at the posterior margin, which is regularly rounded.

Anterior portion of dorsal plate quadrangular, a little wider than long, and a half wider than the carapace; posterior portion narrower than the anterior, strongly tapered posteriorly and bluntly rounded. Genital segment small, with rather flat sides; abdomen nearly quadrangular, as wide as long; caudal rami short rounded knobs, less than one-fifth the length of the abdomen. Third legs widely separated, very large, and hood-shaped; fourth legs biramose, divided to their base, the endopod only one-third the length of the exopod, both rami foliaceous and bluntly rounded. Length, without fourth legs, 4–5 mm.; with fourth legs, 6–7 mm.

Male.—Short and stocky; carapace as wide and about as long as the body, with smoothly convex margins. Body obovate, one-fifth longer than wide, bluntly rounded posteriorly; genital segment narrower than the free thorax; abdomen much narrower than the genital segment; caudal rami very small. Third and fourth legs cylindrical, uniramose, bluntly pointed, third pair only half as long as the fourth. Length, excluding fourth legs, 2 mm.; including fourth legs, 2.75 mm.

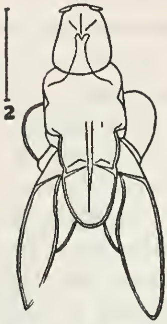

FIGURE 284.—*Lernanthropus brevoortiae:* Female, dorsal

Remarks.—This species was originally found in Vineyard Sound and is common there upon the gills of the menhaden. Beaufort is the only known locality outside the present area, as recorded above.

Family EUDACTYLINIDAE

Genus KRØYERIA Beneden, 1853

Female.—Head fused with the first segment and covered with a carapace, having lateral and median posterior lobes. In the sinus between the two lobes on each side is a movable styliform process, attached on the dorsal surface and extending backward along the side of the free thorax. Second, third, and fourth segments free, without processes, but each with a pair of dorsal plates; fifth and genital segments more or less completely fused, elongate, and cylindrical or slightly flattened. Abdomen short, 1- to 3-segmented; caudal rami long, narrow, and armed with setae. First antennae 6- or 7-segmented; second antennae chelate; maxillipeds with powerful terminal claws; four pairs of biramose swimming legs, the rami 3-segmented; egg strings linear.

Male.—Carapace like that of female; second and third segments about the same size, fourth segment often enlarged; fifth and genital segments fused, but much shorter and narrower than those of the female. Abdomen relatively longer and 3-segmented; caudal rami long and armed with plumose setae; antennae, mouth parts, and legs like those of the female.

KEY TO THE SPECIES (FEMALES)

1. Abdomen 3-segmented; fused fifth and genital segments only five
 times as long as wide---------------------- gracilis, new species (p. 453)
 Abdomen 1-segmented; fused fifth and genital segments at least
 12 times as long as wide-- 2
2. Second endopod segment of swimming legs with a row of papillae
 close to margin on ventral surface-------- papillipes, new species (p. 454)
 Second endopod segment of swimming legs with an inner seta
 and without papillae on ventral surface----------------- lineata (p. 456)

KRØYERIA GRACILIS, new species

PLATE 29

Occurrence.—Fifty females and three males were taken from the gills of the brown shark (*Carcharhinus milberti*), July 25, 1923. One female has been selected as the species type, with U.S.N.M. No. 56646; the males have been placed in a separate vial, with U.S.N.M. No. 56645. Seven males were obtained from the nostrils of a great blue shark (*Galeus glaucus*), August 9, 1926, and 25 males and females from the gills of another great blue shark the following day. These sharks were captured in the fish nets on Marthas Vineyard.

Color.—Body a uniform yellowish white without pigment.

Female.—Carapace one-fourth wider than long; cephalic area triangular, the apex posterior, the base anterior and projecting in front of the lateral areas. Styliform process stout, extending to the posterior margin of the third segment, and curved inward at its tip. Second, third, and fourth segments about the same length but diminishing in width, the fourth segment less than half the width of the carapace. Fused fifth and genital segments much wider than the three preceding segments, five times as long as wide and tapered posteriorly. Abdomen less than one-seventh the length and one-fourth the width of the fifth and genital segment, distinctly 3-segmented, the segments diminishing backward. Caudal rami longer than the anal segment, six times as long as wide, each tipped with two long and two short setae.

First antenna 6-segmented, sparsely armed with spines, but no setae; second antenna with a stout chela; basal segment of maxilliped long, narrow, and but little swollen, terminal claw enlarged at its base and abruptly bent beyond its center. The two basal segments of the first exopod without outer spines, but with inner setae, terminal segment with four spines and four setae. Basal segment of endopod with an inner seta; second segment without an inner seta but with a row of short spines on the outer margin; terminal segment also with a row of outer spines and with six apical and inner setae. In the fourth legs the two basal exopod segments have an inside seta but no outside spine; the terminal segment has two spines and four setae. The basal segment of the fourth endopod has an inner seta, the second segment has both an inner and an outer seta, and a row of short spines on the outer margin, the terminal segment has two or three spines on the outer margin and two apical setae. Total length, 7–8 mm. Carapace and free thorax combined, 1.75 mm. Genital segment, 5 mm. long, 1 mm. wide. Ovisacs, 10 mm.

Male.—Carapace one-third wider than long; cephalic area somewhat pentagonal; styliform processes stout but only reaching the middle of the second segment. Second and third segments about the same width and length, fourth segment narrower and longer; fifth and genital segment one-fifth longer than the free thorax, the same width as the fourth segment anteriorly, but tapered posteriorly. Abdomen 3-segmented, the segments diminishing in length and width backward; caudal rami longer than the anal segment, ten times as long as wide, each with three apical setae and a fringe of cilia on the inner margin. The two basal segments of the fourth exopod have an inner seta but no outer spine, the terminal segment has two apical spines and four setae. The basal segment of the endopod has an inner seta and a smooth outer margin; the second segment has a seta at each distal corner, and a row of small spines proximal to the outer seta; the terminal segment has three small spines on the outer margin and two apical setae. All the swimming legs have a pair of acuminate spines, one at each end of the short rib joining their bases across the midline. Total length, 4–4.5 mm.

Remarks.—This species can be identified most quickly by the 3-segmented abdomen, which in the other two species has only a single segment. The number of specimens recorded above shows that it is at least a common species, although these large sharks are captured only occasionally.

KRØYERIA PAPILLIPES, new species

PLATE 30, *a–i*

Occurrence.—A female was taken from the gills of the hammerhead shark (*Sphyrna zygaena*) in August, 1911, and six males and females were taken from the gills of the tiger shark (*Galeocerdo arcticus*), August 13, 1926. A female of this latter lot is the holotype of the species, U.S.N.M. No. 56672. Both sharks were captured in the fish nets on Marthas Vineyard.

Color.—Body yellowish white, darker and more or less brownish in the thicker parts of the cephalothorax and abdomen; ovisacs brown.

Female.—Carapace one-fourth wider than long, with evenly rounded lateral margins; cephalic area suborbicular, as wide as long;

styliform process scarcely reaching the middle of the second segment. Second and third segments about the same length, fourth segment a little longer and enlarged where it joins the fused fifth and genital segments. Each of these three segments has a pair of small dorsal plates, which are narrowed anteriorly and adherent to the dorsal surface, the whole of which they do not cover. The fused fifth and genital segment is a little wider than the three preceding segments, cylindrical, and more than twelve times as long as wide, with straight sides. Abdomen composed of a single segment, one-sixth as long as the genital segment, four times as long as wide, tapered somewhat at both ends, and attached to the genital segment on a level with the ventral surface of the latter. Caudal rami short, two and a half times as long as wide, each tipped with three minute setae.

First antenna 6-segmented, the basal segment the longest, the terminal segment tipped with two slender spines and a fingerlike process, the other segments sparingly armed with spines and without setae. Second antenna slender, the dactylus of the terminal chela with a small accessory spine on its inner margin, the fixed finger nearly straight and hollowed at the end to receive the tip of the dactylus. Basal segment of maxilliped considerably swollen, bent outward near its proximal end and sharply pointed at its distal posterior corner; terminal claw slender and bent abruptly beyond its center.

The rami of each of the first four pairs of legs are about equal in length; the two basal exopod segments carry a spine at the outer distal corner and a seta on the inner margin. The terminal segment has two outer spines and four plumose setae in the first legs, and two outer spines and five setae in the other three pairs of legs. The basal segment of the endopod has an inner seta in all four pairs, the second segment has an inner seta in the fourth pair only, but along the outer margin of this segment in all four pairs of legs there is a row of small papillae on the ventral surface close to the margin. The tips of these papillae project slightly beyond the margin and each carries two or three long cilia; the margin itself is also fringed with cilia. The terminal segment of the endopod in the first three pairs of legs carries six stout setae, in the fourth legs only three setae. There are no spines on the ribs connecting the bases of the pairs of legs as is common in most of the species of this genus. Total length, 10.5–12 mm. Carapace and free segments combined, 2–2.2 mm. Width of carapace, 1.25 mm.; of genital segment, 0.65 mm. Ovisacs. 7 mm. long.

Male.—Carapace one-half wider than long; cephalic area somewhat narrowed posteriorly; styliform processes not reaching the center of the second segment. Second, third, and fourth segments about the same width, which is one-third that of the carapace;

second and third segments the same length, fourth segment one-half longer, all three segments with dorsal plates similar to those in the female. Fused fifth and genital segment a little longer and considerably narrower than the free thorax, tapered backwards. Abdomen 3-segmented, the segments diminishing posteriorly; caudal rami longer than the anal segment, twelve times as long as wide, each tipped with three small setae and fringed with cilia on the inner margin.

Segmentation of first antenna very indistinct; second antenna, mouth parts and swimming legs like those of the female. The second endopod segment in all four pairs of legs is armed on its ventral surface near the outer margin with a row of small papillae, like those of the female. Total length, 4.5–5 mm. Carapace and free thorax combined, 2 mm.

Remarks.—This species can be recognized at once by the curious papillae on the ventral surface of the second endopod segments. In the female also the body is exceptionally long and narrow.

KRØYERIA LINEATA Beneden

Plate 30, *j–m*

Krøyeria lineata Beneden, Bull. Akad. Roy. Belgique, vol. 20, p. 20, pl. 1, 1853.

Occurrence.—Found on the gills of the hammerhead shark, *Sphyrna zygaena*, captured in the fish nets on Marthas Vineyard.

Color.—Body yellowish white, darker and more or less brownish in the thicker parts of the cephalothorax and abdomen; egg strings dark brown.

Female.—Carapace as long as wide; cephalic area oblong, the frontal margin projecting; lateral areas with a projecting anterior corner and short posterior lobes; styliform processes extending to the middle of the third segment and straight (Beneden) or sometimes to the middle of the fourth segment and curved inward at their tip (Claus). Second segment short, third and fourth segments each a little longer, the third about one-third the width of the carapace. Fused fifth and genital segment wider than the free thorax and eleven times as long as wide. Abdomen composed of a single segment, the same width throughout, two-fifths as wide as the genital segment and four and a half times as long as wide. Caudal rami nearly half the length of the abdomen, four times as long as wide, each tipped with three long plumose setae. First exopod without outer spines, first and second segments with an inner seta, third segment with five setae; first and second endopod segments with inside seta, terminal segment with three setae. Total length, 7–8 mm.

Male.—Carapace longer than wide; styliform process reaching the posterior margin of the second segment; second, third, and fourth segments about the same length and width; fused fifth and genital segment shorter than the free thorax and only three times as long as wide. Abdomen 3-segmented, the two basal segments about the same length, the anal segment a little shorter. Caudal rami longer than the anal segment, twelve times as long as wide, each tipped with three long plumose setae. Total length, 5–5.5 mm.

Remarks.—Beneden claimed to have found the rudiments of a fifth pair of legs at the posterior corners of the genital segment, but Claus disproved this. The species can be recognized by the angular front corners of the lateral areas of the carapace and the length of the styliform processes.

KRØYERINA, new genus

Female.—Carapace triangular, strongly narrowed anteriorly, widest near the posterior margin, without posterior lobes and sinuses or styliform processes, and with or without a cephalic area. Second, third, and fourth segments about the same length and width, the latter scarcely more than half the width of the carapace. Fifth and genital segments fused, nearly as wide as the carapace, without posterior lobes or with very short ones. Abdomen 2-segmented, basal segment much shorter than terminal; caudal rami narrow and elongate, each tipped with three setae. First antenna 6-segmented; second antennae chelate; maxillipeds with a strongly curved apical claw. All four pairs of legs biramose, rami 3-segmented.

Male.—Similar to the female, but smaller; carapace about as long as wide; fused fifth and genital segment relatively shorter; abdomen 3-segmented, anal segment less than half the length of the basal segment and considerably narrower; caudal rami longer than the anal segment and slender; antennae, mouth parts, and legs like those of the female.

Genotype.—*Krøyerina nasuta*, new species.

KEY TO THE SPECIES (FEMALES)

1. Fused fifth and genital segment less than four times as long as wide, its posterior corners prominent________ nasuta, new species (p. 457)
Fused fifth and genital segment more than eight times as long as wide, its posterior corners smoothly tapered_ elongata, new species (p. 459)

KRØYERINA NASUTA, new species

Plate 31, *a–k*

Occurrence.—Four females from spiracles of large sting ray (*Dasybatus marinus*), July 18, 1923; a female with attached male from spiracle of a sting ray, August 15, 1923; two females from spiracle of sting ray, July 7, 1926. The female with attached male is made the species holotype, with U.S.N.M. No. 56644.

Color.—Body a uniform grayish white; egg strings brownish.

Female.—Carapace triangular with rounded corners, the apex forming the frontal margin between the bases of the first antennae, the base of the triangle forming the posterior margin and showing neither lobes nor sinuses nor styliform processes. The width, greatest near the posterior margin, and the length of the carapace are about equal. The cephalic area is triangular, the apex of the triangle at the center of the carapace. The second, third, and fourth segments are about the same length, and a little more than half as wide as the carapace; their lateral margins are strongly convex, and there are no indications on their dorsal surfaces of the paired dorsal plates found in *Krøyeria.* The fused fifth and genital segment is nearly as wide as the carapace and about three and a half times as long as wide; the egg strings attached to its posterior corners contain 18 eggs each, which are proportionately larger in diameter and much thicker than in *Krøyeria.* The abdomen is 2-segmented, the anal segment nearly twice the length of the basal segment; caudal rami four times as long as wide, each with three short apical setae.

The first antenna is filiform and 6-segmented, the first, third, and sixth segments much longer than the other three, the second and sixth segments with setae, the others with spines only. Second antenna as long as the first and standing out prominently from the ventral surface of the head. The terminal chela is quite different from that found in *Krøyeria;* there a curved and movable dactylus shut down into the hollowed tip of a fixed finger and the bases of the two digits were widely separated. Here apparently both digits are movable and their bases are in contact; they more resemble a pair of parallel pliers than a chela. The second maxillae are 3-segmented, the basal segment stout, the second segment slender, the terminal segment in the form of a triangular claw. The distal end and the outer margin of the second segment are armed with long cilia, and the outer margin of the claw has a fringe of long spines. In the maxillipeds the basal segment is much swollen on its inner margin; the terminal claw is as long as the basal segment and shuts down over this swelling. The spines on the outer and the setae on the inner margins of the three segments in the rami of the swimming legs are arranged as follows: First exopod, 1–1, 1–1, 2–4; first endopod, 0–1, 1–1, 0–6; second exopod, 1–1, 1–1, 3–4; second endopod, 0–1, 0–1, 1–5; third exopod, 1–1, 1–1, 3–4; third endopod, 0–1, 0–1, 1–4; fourth exopod, 1–1, 1–1, 3–4; fourth endopod, 0–1, 0–1, 1–3. In the terminal endopod segment of the second, third, and fourth legs the spine is not on the outer margin but is terminal and lies between the two outer setae. Total length, 3.85–4.15 mm.

Male.—Carapace like that of the female; second and third segments two-thirds as wide as the carapace, narrowed anteriorly, widest near the posterior margin; fourth segment spindle-shaped, narrowed both anteriorly and posteriorly, widest through the center. Fused fifth and genital segment a little longer and narrower than the free thorax, and tapered posteriorly. Abdomen 3-segmented, second segment as long as the first but narrower, anal segment less than half the length of the second segment. Caudal rami longer than the anal segment, four times as long as wide, divergent, each tipped with three equal setae. Antennae, mouth parts, and legs like those of the female. Total length, 2.3–2.5 mm.

Remarks.—This genus can be distinguished from the preceding one by its triangular cephalothorax, which is destitute of posterior lobes and styliform processes. The species may be identified by the relative proportions of the fused fifth and genital segment. The finding of several specimens in the spiracles of the few sting rays examined would seem to indicate that the species is fairly common.

KRØYERINA ELONGATA, new species

PLATE 31, *l–p*

Occurrence.—A few specimens, all females, were obtained from the gills of the great blue sharks (*Galeus glaucus*) captured on successive days in August, 1926, in the fish nets on Marthas Vineyard. The female holotype is U.S.N.M. No. 56673.

Color.—Body a uniform snowy white; egg strings grayish.

Female.—General form elongate and narrow; carapace triangular with rounded corners, one-fifth wider than long. The base of the triangle forms the posterior margin of the carapace, is nearly straight, and shows neither lobes, sinuses, nor styliform processes. Second, third, and fourth segments about the same length but diminishing slightly in width, the fourth segment a little more than half the width of the carapace. Fused fifth and genital segment wider than the free thorax, but not so wide as the carapace, eight and a half times as long as wide, with straight sides and smoothly rounded posterior corners. Abdomen one-sixth as long and half as wide as the genital segment, 2-segmented, the anal segment spindle-shaped and twice as long as the basal segment. Caudal rami linear, five times as long as wide, each tipped with three minute setae.

First antennae indistinctly 7-segmented, sparsely armed with rather short spines; second antenna stout, terminated by a pair of pinchers the digits of which are in contact at their base and overlap at their tips. Second maxilla much shorter than in *nasuta*, but similarly formed, except that the triangular claw has no spines on its outer margin. The basal segment of the maxilliped is not swollen so much and the terminal claw is not so long. The arrangement of the spines and setae on the three segments of the swimming legs is as follows: First exopod, 1–1, 1–1, 2–4; first endopod, 0–1, 0–1, 0–6; second exopod, 1–1, 1–1, 3–4; second endopod, 0–1, 0–1, 1–4; third exopod, 1–1, 1–1, 3–4; third endopod, 0–1, 0–1, 1–4; fourth exopod, 1–1, 1–1, 3–4; fourth endopod, 0–1, 0–1, 1–4. On the terminal endopod segment of the second, third, and fourth legs the spine is between the two outer setae and is terminal rather than on the outer margin, as in the preceding species. Total length, 13.6 mm. Fused fifth and genital segment, 9.5 mm. long, 1.15 mm. wide. Ovisacs, 14 mm. long.

Remarks.—This species can be recognized by its exceptional size, the body plus the ovisacs being 25 mm. in length. It is possible that the great blue shark is its only host, but more probable that it will be found also upon the gills of other large sharks.

Genus NEMESIS Risso, 1826

Female.—Head fused with first segment, carapace oval or elliptical and longer than wide; second, third, and fourth segments wider than carapace, each covered with a dorsal plate the sides of which curve around onto the ventral surface. Fifth segment usually reduced in width, its dorsal plate just reaching either lateral margin; genital segment smaller than the fifth segment; abdomen narrower but longer than the genital segment, 2- or 3-segmented; caudal rami minute and armed with short spines. First antennae 10- to 15-segmented, filiform; second antenna uncinate; maxillipeds huge, projecting far beyond the carapace, uncinate; first 4 pairs of legs biramose, rami 2-segmented, fifth pair uniramose, 1- or 2-segmented.

Male.—Carapace elliptical; second, third, and fourth segments as wide as carapace or wider and not curved over ventrally; fifth segment narrower and much shorter than the fourth; genital segment enlarged; abdomen 3- or 4-segmented, the segments diminishing backward; caudal rami differing considerably in size, with or without plumose setae; antennae, mouth parts, and swimming legs like those of the female.

KEY TO THE SPECIES (FEMALES)

1. Fifth segment as wide as fourth; abdomen 2-segmented; sinuses between thoracic segments deep________________________ lamna (p. 461)
   Fifth segment much narrower than fourth; abdomen 3-segmented; sinuses narrow and shallow________________________________ 2
2. Second segment with a notch on each lateral margin; fourth segment with lobes at posterior corners_______________ atlantica (p. 463)
   Second segment with smooth lateral margins, no notches; fourth segment without lobes at posterior corners__ pallida, new species (p. 464)

NEMESIS LAMNA Risso, 1826

PLATE 32

Nemesis lamna RISSO, Histoire naturelle des principales productions de l'Europe Méridionale, vol. 5, p. 135, pl. 5, fig. 25, 1826.

Nemesis mediterranea HELLER, Reise der Österreichischen Fregatte *Novara*, vol. 2, pt. 3, Crustacea, p. 220, pl. 21, 1865.

Occurrence.—Both sexes were obtained from the gills of the great white shark (*Carcharodon carcharias*) in August, 1916, and again from the same host in July, 1924, both sharks caught in the fish nets on Marthas Vineyard.

Distribution.—Mediterranean (Risso, Milne Edwards, Brian, Valle); European seas (Roux, Guérin); California coast on gills of mackerel shark (*Isurus punctatus*) (Wilson).

Color.—Body a light tan, the dorsal surface of the carapace and the centers of the second, third, and fourth segments in the female a light brown; spermatophores dark reddish brown, almost black; egg strings dark brown.

Female.—Cephalothorax obovate, frontal margin straight, posterior portion overlapping the second segment considerably narrowed. The dorsal carapace does not reach the posterior margin, but leaves a narrow free border around the posterior end. Second, third, and fourth segments about the same length and wider than the carapace, with deep lateral sinuses between them. Each of these segments carries on its dorsal surface a pair of plates, which are so completely fused as to appear single, are inlaid into the dorsal surface, and cover only the center of the segment, leaving a wide naked border around the lateral and posterior margins. The lateral sinuses between the fourth and fifth segments are deeper than the two pairs that precede them, and their inner ends are curved backward into the anterior margin of the fifth segment. The latter is fully as long as the fourth segment and scarcely narrower, and carries on its rounded posterior corners the rudiments of the fifth legs. The genital segment is about one-third the width of the fifth segment, with strongly convex lateral margins. Abdomen half as wide as the genital segment, 2-segmented, the anal segment twice as long as the basal. Egg strings narrow, but three times as long as the body; spermatophores ovoid, the two fully as large as the genital segment and extending out at right angles to the body axis.

First antennae filiform, 12 to 15 segments, the basal segment considerably wider and longer than any of the others. Second antennae longer than the first pair, 3-segmented with a terminal claw, which is strongly curved and bears on its inner margin near the base a short bipartite spine; the second segment also carries a small spine on its inner margin. Second maxilla 2-segmented, the segments about equal in length, tipped with a stout claw and a swollen pad covered with spines. Maxillipeds large and powerful, projecting far beyond the lateral margins of the carapace; terminal claw considerably shorter than the basal segment and strongly curved near its tip.

The first four pairs of legs are biramose, the rami 2-segmented; in the first pair the basipods are not swollen, the basal segment of the exopod is broad and curved inward, and is usually folded against the basal segment, with its tip overlapping the endopod. Its outer margin is fringed with a row of fine saw teeth; the distal segment is small and conical and tipped with three small spines. The endopod is made up of a basal segment and two small conical processes, each tipped with a minute spine; outside the base of the endopod is a large plumose seta. The basipod segments of the second, third, and fourth legs are swollen into large triangular sacs, which cover the lateral sinuses between the thoracic segments, and thus become visible in dorsal view. The legs themselves are attached to the ventral surfaces of the sacs; in all three pairs the basal segment of each ramus is much wider than the terminal and is produced into a long spine on one or both sides of the latter; the terminal segment is conical with stout spines. The outer margin of each basal exopod segment is armed with one or more rows of spiny teeth; in the second legs the concave distal margin of this segment also has a row of teeth. In these three pairs of legs the outer spine of the basal exopod segment reaches beyond the tip of the end segment. The fifth legs are minute unarmed fingerlike processes attached to small knobs on the ventral surface of the fifth segment near the posterior corners. Total length, 10–12 mm. Carapace and free thorax, 8–9 mm. long; carapace, 2; free thorax, 2.5 mm. wide. Ovisacs, 30 mm. long.

Male.—Carapace one-half longer than wide, with a straight frontal margin and a narrowed posterior end overlapping the second segment as in the female; second, third, and fourth segments wider than the carapace, but diminishing in width backward, the sinuses between the segments narrow, shallow, and angular. Fifth segment little more than half the width and a third of the length of the fourth segment, with rudiments of fifth legs on its ventral surface. Genital segment wider than the fifth segment and two and a half times as long, with strongly convex sides. Abdomen 3-segmented, segments diminishing in width posteriorly, the anal segment the longest, the second segment the shortest. Caudal rami short, each tipped with three short spines.

Antennae and mouth parts like those of the female; maxillipeds relatively larger and tipped with very powerful claws. First and second legs similar to those of the female, except that they are more plentifully armed with short spines. In the third and fourth legs the terminal segments of the rami are lengthened, especially the endopods, whose end segment is more than twice as long as the basal segment, and is tipped with long spines curved away from each other. The fifth legs are 1-segmented, fingerlike, and each is tipped with two tiny spines; the ventral plates on the genital segment are large and divergent, and each carries a long seta on its inner margin near the tip. Total length, 6.25 mm. Carapace and free thorax, 5 mm. long; second segment, 2.25 mm. wide.

Remarks.—The female of this species has not been described since 1865 when Heller called it *Nemesis mediterranea*, but it is evidently the same species that had been described by Risso in 1826. A new description of the female is here presented, and the male is described for the first time in order that the type of the genus may become better known. This male and the one belonging to the new species *pallida* (p. 465) agree very closely and make it practically certain that the specimens described as the male of the Jamaican species, *versicolor* [15] did not belong to the present genus but to *Eudactylina.*

NEMESIS ATLANTICA Wilson

PLATE 33, *a*

Nemesis atlantica WILSON, Proc. U. S. Nat. Mus., vol. 60, art. 5, p. 60, pls. 9, 10, 1922.

Occurrence.—Both sexes found on the gills of the thresher shark (*Vulpecula marina*) in July, 1902, and on the gills of the dusky shark (*Carcharhinus obscurus*) in July, 1910, captured in the fish nets on Marthas Vineyard.

Distribution.—Beaufort, N. C., on gills of sharp-nosed shark (Wilson).

Color.—Body a bright yellow and nearly opaque, the digestive tract and egg strings dark brown, almost black, the legs white, the bases of the mouth parts tinged with a dull rust color. The entire maxillipeds are sometimes bright crimson and nearly always have a reddish tinge.

Female.—Carapace elliptical, longer than wide; second, third, and fourth segments the same length and width, a little wider than the carapace; second segment with a distinct notch on each lateral margin; fourth segment with short lobes at its posterior corners; fifth segment narrower, its posterior margin 3-lobed. Genital segment transversely elliptical, narrower than fifth segment but nearly twice as wide as long. Abdomen 3-segmented, anal segment longer than two basal segments combined; caudal rami narrow spindle-shaped, longer than anal segment, each with 4 short apical setae. Terminal claw of second antenna bifid at tip; second segment of second maxilla club-shaped, armed at its distal end with a row of stout spines; terminal claw with five longitudinal rows of spines. Total length, 4.5–5 mm.

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[15] Proc. U. S. Nat. Mus., vol. 44, p. 238, 1913.

Male.—Carapace elliptical, one-third the body length; second segment the same width as the carapace, third and fourth segments narrower; fifth segment narrower than fourth and only one-fourth as long. Genital segment as wide as fourth segment and as long as wide, with strongly convex sides. Abdomen 4-segmented, the two basal longer than the two terminal segments, their lateral margins convex; caudal rami broad, longer than the last two abdominal segments combined, each tipped with three plumose setae. Total length, 2–2.25 mm.

Remarks.—This parasite clings to the very tips of the gill filaments; when removed and placed in sea water, the male can swim rather clumsily, while the female is helpless.

NEMESIS PALLIDA, new species

Plate 33, *b–p*

Occurrence.—Both sexes have been found in abundance on the gills of the following large sharks captured in the fish nets on Marthas Vineyard: The thresher shark (*Vulpecula marina*) in August, 1922, 1923, and 1925; the brown shark (*Carcharhinus milberti*) in July and August, 1923; the sand shark (*Carcharias taurus*) in July, 1923; the tiger shark (*Galeocerdo arcticus*) in August, 1925; the great white shark (*Carcharodon carcharias*) in July, 1924, and August, 1925; the dusky shark (*Carcharhinus obscurus*) in August, 1925.

One female from the thresher shark with attached male is made the species holotype, with U.S.N.M. No. 56632.

Color.—Body pale yellowish white, contents of digestive tract showing as an indistinct dark streak through the center of the body; egg strings brown.

Female.—Carapace elliptical, longer than wide and evenly rounded; second and third segments a half wider than the carapace, the second segment with smooth sides; fourth segment a little narrower than the third. The plates covering the dorsal surfaces of these three segments extend around the sides of the segments, but the ends do not stand out free from the ventral surface, as in *atlantica* and *lamna.* Instead the segment itself forms a thick pad, and the plate simply covers the outside surface of the pad. The fifth segment is much narrower than the fourth, with a 3-lobed posterior margin, the middle lobe much wider than the lateral ones. The dorsal plate on this fifth segment does not reach the lateral margins, but leaves a free border on either side; there is also a plate on the ventral surface, wider and shorter than the dorsal one, with a posterior median sinus, indicating that it is made up of two plates fused.

Genital segment wider than long, with the genital openings at the posterior corners directed diagonally outward and backward; to each opening is attached a spherical spermatophore, reddish purple in color and nearly half the size of the genital segment. The openings of the oviducts are on the dorsal surface, about midway between each lateral margin and the midline; the egg strings are rather slender and more than twice the length of the body. Abdomen 3-segmented, the anal segment as long as the two basal segments combined; caudal rami laminate, almost twice as long as wide, each with three small apical setae.

The first antennae are apparently 12-segmented, but the segmentation of the basal half is very indistinct and seems to vary in different specimens. The terminal claw of the second antenna has a curved spine on its inner margin near the center; the base of the claw projects inwardly, and distal to the projection is a hairlike seta; the other segments are unarmed. The terminal claw of the maxillipeds is stout and bent rather abruptly near its tip; on its inner margin are two small spines.

In the first legs the exopod is relatively shorter and broader than in the two species already described, and is attached closer to the endopod. Its distal segment has two apical setae equal in length. The two segments in each ramus of the second, third, and fourth legs are about the same length, but the basal segment is wider and armed at each distal corner with a short spine, which extends outward along the end segment, but scarcely reaches beyond its center. The end segments of the rami are armed with spines in the following numbers: Second exopod, 7; endopod, 6; third exopod, 5; endopod, 4; fourth exopod, 6; endopod, 4. The fifth legs are broad and spatulate, and each is armed with a single apical spine. Total length, 4.5–5 mm. Second segment, 1.75 mm. wide. Egg strings, 10 mm. long.

Male.—Carapace elliptical, longer than wide, the frontal margin straight; second segment a little wider than, third segment the same width as, the carapace; fourth segment narrower; fifth segment two-thirds as wide and one-fourth as long as the fourth segment. Genital segment as wide as the fourth segment and considerably longer; the plate covering this segment reaches entirely around the segment at the anterior end; on the dorsal surface it does not reach the posterior end of the segment, but leaves the last quarter uncovered; on the ventral surface it only covers the anterior third, and behind it is a pair of ventral plates, one on either side of the mid line, which are divergent and reach farther back than the dorsal plate. The posterior end of these ventral plates is visible in dorsal view on either side of the segment behind the dorsal plate, and each is tipped with one long and two very short setae. The abdomen is 4-segmented, the basal segment the widest and as long as the second and third segments combined; the anal segment is a little longer than the penultimate segment. The caudal rami are elliptical, laminate, one-half longer than wide, and each is tipped with three plumose setae.

The first antennae are like those of the female, very indistinctly jointed in the basal half, but apparently made up of 12 segments. The second antennae and mouth parts correspond to those of the female; the maxillipeds are relatively larger but show similar details. In the swimming legs the terminal segments, especially of the endopods, are relatively longer, and both rami are armed with plumose setae as well as spines. The arrangement of the spines and setae is as follows: Second exopod, 1–1, 3–4; second endopod, 1–1, 0–6; third exopod, 1–1, 3–5; third endopod, 1–1, 1–4; fourth exopod, 1–1, 3–7; fourth endopod, 1–1, 1–4. The spine on the terminal endopod segment of the third and fourth legs is not at the outer corner, but between the two outer setae; it is bent upward away from the plane of the four setae and is somewhat hooked at the tip, and thus forms an effective clasping organ. The fifth leg is a 1-segmented lamella, nearly as wide as long, and tipped with three medium-sized plumose setae. Total length, 4–5 mm.

Remarks.—This is the commonest species in the area, as evidenced by the number of specimens obtained and the variety of hosts. It may be determined by the smooth lateral margins of the second segment, and the absence of lobes at the posterior corners of the fourth segment.

Genus EUDACTYLINA Beneden, 1853

Female.—Head fused with first segment; four free segments with dorsal plates; genital segment smaller than fifth segment, oviduct openings ventro-lateral; abdomen 2-segmented; caudal rami laminate, with nonplumose setae. First antenna usually 5-segmented, the terminal portion (three segments) at right angles to the basal, both portions heavily armed with spiny claws. Second antenna 3-segmented, with one or more apical claws; first maxilla deeply bilobed, with spiniform setae; second maxilla 3-segmented, with a pectinate apical claw; maxillipeds large, with a stout vertical chela made up of two digits, the tip of one shutting into the tip of the other. First four pairs of legs biramose, rami of first pair 2- or 3-segmented, of the other pairs 3-segmented, except the fourth endopod, which is sometimes 1-segmented; fifth legs uniramose, lamellar, wholly visible in dorsal view.

Male.—Head fused with first segment; four free segments with dorsal plates, the first one the longest; fifth segment nearly as wide as the fourth, but much shorter; genital segment wider than the abdomen, without leg rudiments; abdomen nearly as long as the cephalothorax, 3-segmented; caudal rami elongate, with apical plumose setae.

First antenna 7-segmented, with stout claws near the base and one or two at the tip, geniculate as in the female, the basal portion made up of two segments. Second antenna uncinate; maxillipeds also uncinate and not chelate as in the female. Both rami in the first four pairs of legs 3-segmented, the two basal segments of the endopods unarmed except the first segment of the second endopod, which carries a long curved spine; fifth legs uniramose, lamellar, larger than in the female. A single species within the present area.

EUDACTYLINA SPINIFERA, new species

PLATE 34

Occurrence.—Six females were taken from the gills of a brown shark (*Carcharhinus milberti*) captured in the fish nets on Marthas Vineyard, August, 1923. The female holotype is U.S.N.M. No. 56621.

Color.—Body a uniform yellowish white, entirely without pigment markings.

Female.—Carapace elliptical, one-fourth longer than wide, evenly rounded anteriorly and posteriorly, without lobes or spines at the posterior corners. The next three segments increasing in length and width backward, the fourth segment twice the length of the second and considerably wider; fifth segment the same length as the second but narrower. Genital segment half the width and two-thirds the length of the fifth segment; abdomen shorter and narrower than the genital segment, its two segments about the same length; caudal rami a little longer than the anal segment, each tipped with three minute setae. Egg strings less than half the length of the body, each as wide as the genital segment; eggs few in number, large, and but little flattened.

First antenna 7-segmented, the basal segment much longer but no wider than the next two segments, the three together making up the basal portion, the four terminal segments turned backward nearly at right angles. The third, fourth, and fifth segments each carry on their outer margins two short and stout spines. The second antenna is 3-segmented, the middle segment the shortest and armed on its inner margin with two stout spines, the third segment with a curved apical claw having an accessory spine at its base. The second segment of the second maxilla has a fringe of spiny teeth along its outer margin, and two small spines on the ventral surface at the distal end; the terminal claw is pectinate. The two digits of the chela of the maxillipeds are about the same length, and each is 2-segmented. The end segments are enlarged; the one on the movable digit is spherical and fits inside the other, which is bowl-shaped.

The first legs are covered with spines on the ventral surface, the exopod is 3-segmented, the endopod 1-segmented, with a single apical seta and a row of teeth along its inner margin. The rami of the second and third legs are 3-segmented; the second exopod is considerably lengthened and modified for prehension. The exopod of the fourth leg is 3-segmented, while the endopod is a huge spine, much longer and stouter than the exopod; the fifth legs are large 1-segmented laminae, each tipped with a single seta. Total length, 1.5–1.7 mm. Width of fourth segment, 0.35 mm. Length of ovisacs, 0.7 mm.

Male.—Unknown.

Remarks.—This species is so hidden between the gill filaments that it is easily overlooked, and this is probably one reason why it has not been found before. Its most prominent single character is the huge endopod spine of the fourth legs.

EUDACTYLINODES, new genus

Female.—Head fused with first segment; four free thorax segments without dorsal plates; fifth segment nearly twice as long as wide; genital segment smaller than the fifth segment, the oviduct openings dorso-lateral; abdomen 2- or 1-segmented, conical; caudal rami minute, as wide as long. First antennae indistinctly segmented, but apparently made up of eight segments, the second segment with long stout claws, a broad lamina, or spines, the end segment with an apical tuft of spines. Second antenna 3-segmented, uncinate; first maxilla a single dactylose process, with two apical plumose setae. Maxillipeds huge and horizontal, uniramose, made up of a stout basal segment and a terminal portion indistinctly 3-segmented; the latter is longer than the basal segment, elliptically curved, and shuts down against the basal portion. All four pairs of legs biramose, rami 3-segmented, the segmentation often indistinct; fifth legs dactylose, uniramose, 1-segmented, invisible dorsally. Eggs few in number, large and scarcely flattened.

Male.—Head fused with first segment and the widest part of the body; four free segments diminishing in length and width backward; genital segment wider than fourth segment and nearly twice as long as wide, narrowed posteriorly. Abdomen 4-segmented, the segments diminishing in size distally; caudal rami elongate. First antenna 8-segmented, armed as in the female; maxillipeds uncinate and not like those of the female. First four pairs of legs biramose, rami 3-segmented, all three segments of both rami armed with setae;

each fifth leg a small knob with a single seta; sixth-leg rudiments visible on the lateral margins of the genital segment.

Genotype.—*Eudactylinodes uncinata* (Wilson).

Remarks.—The two species here referred to this genus have previously been included in the genus *Eudactylina* by the present author. When they were first described it was realized that they differed considerably from the type species of *Eudactylina*, but as the male remained unknown and might prove to be typical of that genus, it was thought best to place them there temporarily. Now that the male has been found and proves to be very different from the *Eudactylina* male it becomes necessary to establish a new genus for these two species.

KEY TO THE SPECIES (FEMALES)

1. Carapace emarginate posteriorly, with a stout spine at each corner; abdomen 2-segmented.......................... nigra (p. 471)
   Carapace straight or convex posteriorly, without spines; abdomen 1-segmented.......................... uncinata (p. 469)

EUDACTYLINODES UNCINATA (Wilson)

PLATE 35, *a–m*

Eudactylina uncinata WILSON, Proc. U. S. Nat. Mus., vol. 35, p. 453, pl. 74, 1908.

Occurrence.—About 125 specimens, including both sexes, were taken from the gills of two shovel-nosed sharks (*Carcharias taurus*) captured in the fish nets on Marthas Vineyard, one in July, the other in August, 1923.

Distribution.—California coast, gills of soup-fin shark (Wilson).

Color.—Body yellowish white, sometimes tinged with brown, the contents of the digestive system darker in color; egg strings yellow or light orange.

Female.—Carapace quadrilateral, posterior corners without spines; second and third segments narrowed anteriorly, widened posteriorly; fourth segment barrel-shaped; fifth segment twice as long as wide, with straight sides; genital segment half as long and a little narrower than the fifth segment; abdomen longer than genital segment, 1-segmented; caudal rami as wide as long, each with two apical and one outer spine. First antenna 8-segmented, the second segment with two stout curved claws and a broad lamina; second antenna with a short apical claw; endopods of first four pairs of legs longer than exopods, 3-segmented, the second segment with two setae on the inner margin in the first legs, but no seta in the other three pairs; exopods indistinctly segmented, but with three segments indicated by the arrangement of the spines; fifth leg a fingerlike process with an apical spine. Total length, 2.5–2.75 mm.

Male.—Carapace one-third longer than wide, its lateral margins with a double curve, its posterior corners produced into prominent lobes, each tipped with a stout spine. Second, third, fourth, and fifth segments diminishing in length and width backward, the second segment narrower and much shorter than the carapace. Genital segment considerably wider than the fifth segment and tapered distally, as long as the three preceding segments combined, with leg rudiments on its lateral margins near the posterior end. Abdomen 4-segmented, two-thirds as long as the rest of the body, the segments diminishing in length and width backward, the anal segment about one-third the length and a half the width of the basal segment. Caudal rami one-half longer than the anal segment, four times as long as wide, each tipped with three long equal plumose setae and a much shorter one at the outer corner.

First antennae like those of the female, the claws on the second segment longer and sharper, and the spines longer and more numerous. The second segment of the second antenna has a stout process on its dorsal surface near the proximal end; the terminal claw is long and slender and carries two accessory spines on its inner margin at the base. The second maxilla is 2-segmented, the second segment a little shorter than the first and tipped with a stout claw; at the distal end of the second segment near the base of the claw is a transverse row of long hairs and a slender blunt spine at the end of the row. The maxillipeds are uncinate and not chelate as in the female, 3-segmented, the basal segment stout with a small knob on its anterior margin near the base; the second segment is much shorter and more slender, the terminal segment is in the form of a curved claw, with a knob tipped with a seta on its inner margin near the base.

Rami of first four pairs of legs 3-segmented, the segmentation more distinct than in the female. The arrangement of the spines and setae on the three segments of each ramus is as follows: First exopod, 1–1, 1–1, 2–5; first endopod, 1–1, 1–2, 1–5; second exopod, 1–1, 1–1, 3–6; second endopod, 1–1, 1–2, 2–5; third exopod, 1–1, 1–1, 2–6; third endopod, 1–1, 1–2, 2–4; fourth exopod, 1–1, 1–1, 2–5; fourth endopod, 1–1, 1–2, 2–2. In the terminal endopod segment of the second legs one of the spines lies between the two outer setae, at the outer corner of the segment, and in the same segment of the third legs two spines are thus situated. This armature of the legs is quite peculiar and differs from that of the female and also from that of the *similis* male described by T. Scott.[16] Total length, 2 mm. Width of carapace, 0.3 mm.

Remarks.—This species can be recognized at once by the large curved claws and the wide lamina on the second segment of the first antenna. The description given above is the first for the male of the species; it is the only male of the genus thus far found in the area.

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[16] 20th Ann. Rep. Fishery Board Scotland, p. 296, pl. 12, 1902.

EUDACTYLINODES NIGRA (Wilson)

PLATE 35, *n*

Eudactylina nigra WILSON, Proc. U. S. Nat. Mus., vol. 60, art. 5, p. 67, pls. 11, 12, 1922.

Occurrence.—Females in considerable abundance were found on the gills of sand sharks captured in the fish nets on Marthas Vineyard, July, 1902 and 1904.

Distribution.—Not found outside the present area.

Color.—Body yellowish white, the long and irregular ovaries and oviducts brownish, the contents of the digestive tract black; eggs dark brown.

Female.—Carapace somewhat quadrilateral, with a convex frontal margin, a concave posterior margin, and nearly straight sides; each posterior corner carries a stout spine directed diagonally inward and backward. The four free thorax segments increase in length and diminish in width backward; the fifth segment is twice as long and half as wide as the second segment; genital segment a little longer than wide; abdomen 2-segmented, anal segment twice the length of the basal segment. First antennae 8-segmented, the two basal segments enlarged and together fully half the length of the antenna, both segments with a row of spines along the anterior border on the ventral surface, and on the dorsal surface the second segment ends in two claws; second antenna uncinate. Maxillipeds similar to those of the preceding species, the basal segment stout and tapered distally, the terminal portion much longer and strongly curved. End segment tipped with a knob, two claws, and a lamina, subchelate. Rami of first three pairs of legs 3-segmented; fourth exopods 3-segmented, endopods 2-segmented; segmentation in all of the exopods indistinct. Each fifth leg a small process tipped with a single seta; sixth-leg rudiments on the genital segment. Total length, 2.25–2.5 mm.

Male.—Unknown.

Remarks.—This species may be recognized by the spines at the posterior corners of the carapace and by the huge maxillipeds, which project nearly their entire length beyond the margin of the carapace.

EUDACTYLINELLA, new genus

Female.—Head fused with first segment, carapace with a small rostrum at the center of the anterior margin; second, third, fourth, and fifth segments diminishing in width and without dorsal plates; genital segment much narrower than fifth segment; abdomen 2-segmented, basal segment the longer; caudal rami short, cylindrical, unarmed. First antenna 11-segmented and straight, the basal segments scarcely enlarged and without claws; second antenna 4-segmented, uncinate. Basal segments of maxillipeds fused on the midline and projecting downward and forward; terminal claws turned back dorsally and parallel with each other. First four pairs of legs biramose, rami 3-segmented; fifth pair uniramose, 1-segmented.

Male.—Head and free thorax similar to that of the female; fifth segment relatively small and forming a sort of waist between the fourth and genital segments. The latter as wide as the fourth segment and more than twice as long; abdomen 4-segmented, segments diminishing backward. Caudal rami foliaceous and armed with plumose setae; antennae, mouth parts, and swimming legs similar to those of the female. A single species.

Genotype.—*Eudactylinella alba*, new species.

EUDACTYLINELLA ALBA, new species

PLATE 36

Occurrence.—Ten females and a male were found on the gills of a sting ray (*Dasybatus marinus*), August, 1924; the female holotype is U.S.N.M. No. 56667. Four females were taken from the nostrils of another sting ray, July, 1926, both fish captured in the fish nets on Marthas Vineyard.

Color.—Body a clear creamy white, without pigment markings.

Female.—Carapace ovate, widest at the posterior margin, with nearly straight sides, and a knoblike rostrum at the center of the anterior margin. Second segment one-fourth wider than the carapace, with convex lateral margins; third, fourth, and fifth segments diminishing regularly in width, but scarcely at all in length. Genital segment abruptly reduced to half the width of the fifth segment but exceeding the latter in length. Abdomen 2-segmented, basal segment the longer and wider, anal segment with a lateral sinus on either side, indicating a fusion of two segments. Caudal rami only a third the length of the anal segment, and wholly without setae or spines.

First antenna slender and 11-segmented, the basal segments scarcely enlarged and armed with setae only, the whole antenna in a straight line and not geniculate. These antennae are thus very different from those of *Eudactylina* and *Eudactylinodes*. Second antenna 4-segmented, the third segment the longest, the fourth segment tipped with a stout claw, as long as the segment itself; at the base of the claw on the inner margin of the fourth segment are two small spines. Mandibles very long, slender, and cylindrical, with a pectinate blade at the tip; first maxilla short and dactylose, 1-segmented, with two apical setae longer than the segment; second maxilla 2-segmented, the second segment fringed with spiny teeth along its outer margin, the terminal claw fringed with minute hairs. Maxillipeds greatly enlarged, the basal segments completely fused and turned downward and forward along the midline, and reaching far in front of the carapace. They are separated at the tips and each ends in a simple claw, which is folded back dorsally onto the segment. They thus work vertically like those of *Eudactylina* but are radically different in structure.

Rami of the first four pairs of legs subequal in length, 3-segmented, armed in the first legs with setae, in the other pairs with spines only; the exopods have stout spines on the outer margins of each segment. In the first legs the two basal endopod segments carry a spine at the outer distal corner, the end segment carries a single apical seta. In the second and third legs the basal endopod segment has a single spine, the second segment has two spines close together, the end segment has a long apical and a short outer spine. In the fourth legs the basal segment has a row of spiny teeth along its outer margin, the one at the distal corner enlarged, the second segment has a row along its distal margin, and at the outer distal corner a group of three, the end segment has a row around its distal end, the middle spine much longer and stouter than the rest. The fifth legs are each made up of a 1-segmented lamina without spines or setae. Total length, 4.7 mm. Greatest width (second segment), 0.95 mm.

Male.—Carapace elliptical, evenly rounded anteriorly, without a rostrum, and squarely truncated posteriorly; second segment a little narrower than the carapace, third, fourth, and fifth segments diminishing rapidly, fifth segment only a fourth as long as the fourth segment, and much narrower, its sides strongly convex and armed with the rudimentary fifth legs. Genital segment as wide as the fourth segment and twice as long, with nearly straight sides and evenly rounded corners. Abdomen 4-segmented, segments diminishing backward, the anal segment fringed with spines along its posterior margin. Caudal rami as long as the anal segment, each tipped with three plumose setae and two small spines. Antennae, mouth parts, and legs similar to those of the female, except the maxillipeds; these are entirely separate and extend sidewise beyond the margin of the carapace. Total length, 2 mm. Greatest width (carapace), 0.42 mm.

Remarks.—This species may be identified by the peculiar maxillipeds of the female and in the male by the very short and narrow fifth segment. The fact that it has been found both in the nostrils and on the gills of its host is quite peculiar, since parasites from these two localities usually differ greatly.

Family PSEUDOCYCNIDAE

Genus PSEUDOCYCNUS Heller, 1865

Female.—Head fused with first segment; second and third segments free; fourth and fifth segments fused with the genital segments into a cylindrical body several times longer than wide and uniform in diameter. Abdomen 1-segmented; caudal rami of varying lengths and widths; egg strings longer than the body, eggs strongly flattened. First antennae short, with few segments; second antennae stout and uncinate; maxillipeds large, with a toothed terminal claw. First legs uniramose, 1-segmented, unarmed; second legs biramose, rami 1-segmented, with setae; third and fourth legs uniramose, with setae; fifth legs obsolete.

Male.—First segment narrowed into a short neck connecting the head with the second segment; second, third, and fourth segments about the same width; fifth and genital segments fused and the same width as the preceding segments. Abdomen 1-segmented, abruptly narrowed; caudal rami flattened, elongated, and armed with spines. Antennae and mouth parts like those of the female; first, third, and fourth legs uniramose, 1-segmented, the fourth pair cylindrical, extended laterally, and half as long as the body; second legs biramose, rami 1-segmented.

KEY TO THE SPECIES (FEMALES)

1. Caudal rami one-third as long as entire body, eight times as long as wide, pointed at tip and unarmed____________ appendiculatus (p. 474)
Caudal rami very short, as wide as long, rounded at tip, each with a single apical seta_______________________________ buccatus (p. 476)

PSEUDOCYCNUS APPENDICULATUS Heller

FIGURE 285, *a*

Pseudocycnus appendiculatus HELLER, Reise der Österreichischen Fregatte *Novara*, vol. 2, pt. 3, Crustacea, p. 218, pl. 22, 1865.—WILSON, Proc. U. S. Nat. Mus., vol. 60, art. 5, p. 75, pl. 12, 1922.

Occurrence.—Found on the gills of the long-finned albacore (*Orcynus alalonga*), captured south of Marthas Vineyard, August, 1886.

Distribution.—Atlantic Ocean (Heller); Mediterranean (Richiardi, Carus); North Atlantic, off Spain (Brian); Aden (Bassett-Smith); Loyalty Islands (Stebbing).

Color.—Living specimens are bright red, the oviducts brownish black, deeper toward the posterior end of the body; ovisacs dark brown.

Female.—Carapace ovate, narrowed anteriorly, the posterior corners prolonged into well-rounded lobes; the narrow portion between the lobes represents the first segment and carries the first legs. Second and third segments a little wider than the carapace, each with a pair of rudimentary dorsal plates; fourth and fifth segments fused with the genital segment into a terete trunk six times as long as wide. Abdomen half as wide as the trunk, 1-segmented; caudal rami lanceolate, acutely pointed, divergent, and a third as long as the entire body. First antennae 3-segmented; each second antenna made up of a stout basal segment and a strong terminal claw; maxilliped stout, the terminal claw with a sharp spine on its inner margin near the center. First, third, and fourth legs uniramose, 1-segmented; second legs biramose, rami 1-segmented; fifth legs lacking. Total length, 12–16 mm.

Male.—Carapace ovate, nearly as wide as long, with a small rostrum; behind the head and more or less fused with it the first segment forms a narrow and short neck; the second segment is wider and at least four times as long as the first; the third segment is wider than the second, but shorter; the fourth segment is still wider and longer, the fourth legs extending as rigid cylinders from its lateral margins; the fifth and genital segments are fused, as wide as the fourth, with a small spine at the center of each lateral margin. Abdomen 1-segmented, longer than wide, enlarged at the posterior end; caudal rami longer than the abdomen, divergent, bluntly rounded, each with an apical fringe of minute spines; antennae, mouth parts, and legs similar to those of the female. Total length, 3.5–4 mm.

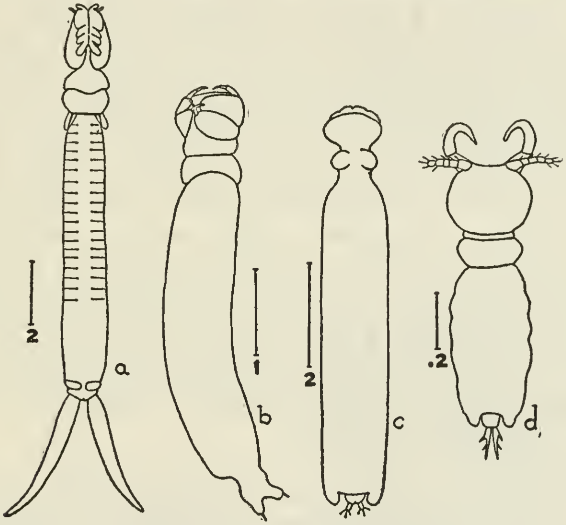

FIGURE 285.—*a, Pseudocycnus appendiculatus,* female, dorsal; *b, P. buccatus,* female, dorsal; *c, Hatschekia hippoglossi,* female, dorsal; *d, H. hippoglossi,* male, dorsal

Remarks.—This species is easily identified by its large size and the exceptional length of the caudal rami.

PSEUDOCYCNUS BUCCATUS Wilson

Figure 285, *b*

Pseudocycnus buccatus Wilson, Proc. U. S. Nat. Mus. vol. 60, art. 5, p. 79, pls. 12, 13, figs. 97–103, 1922.

Occurrence.—Found on the gills of the cero (*Scomberomorus cavalla*), July, 1887, and on the gills of the Spanish mackerel (*Scomberomorus maculatus*), August, 1900, the fish hosts captured in the nets on Marthas Vineyard.

Distribution.—Not found outside the present area.

Color.—Body a light flesh red, oviducts dark brown; prehensile claws yellow tipped with dark red; ovisacs brown deepening in color with development.

Female.—Carapace obovate, considerably widened anteriorly and narrowed posteriorly, where it is divided into two lobes by a narrow median sinus. Second segment not quite so wide as the head, narrowed anteriorly and widest across the posterior margin. Third segment wider and shorter than the second; fourth, fifth, and genital segments fused into a trunk five times as long as wide; egg strings as long as the trunk and one-third its diameter. Abdomen half the diameter of the trunk, 1-segmented; caudal rami short and conical, each tipped with a single seta. First antenna indistinctly 3-segmented; terminal claw of second antenna with an accessory spine on its inner margin near the center, and another at the base. Basal segments of maxillipeds greatly enlarged, terminal claw long and slender. First legs mere knobs; each second leg a bilobed lamina, suggesting two rami; third leg a short and wide lamina; fourth leg obsolete. Total length, 4–5 mm.

Male.—Unknown.

Remarks.—The small size of this copepod and the peculiar structure of the maxillipeds will serve to identify the species. In the original description the first antennae were said to be 6-segmented through a typographical error.

Family DICHELESTHIIDAE

Genus HATSCHEKIA Poche, 1902

Female.—Head separated from the first segment; the first two thoracic segments more or less free, but often fused with each other; the remainder of the thorax fused with the genital segment into an elongate trunk. Abdomen short and 1-segmented, or lacking; caudal rami minute. First antennae filiform, 3- to 6-segmented; second antennae with stout apical claws; maxillipeds slender and uncinate. Two pairs of biramose swimming legs, sometimes rudiments of the third, and even the fourth pairs; fifth pair always lacking. Ovisacs short, eggs large.

Male.—Head and first segment separated; remainder of thorax fused with the genital segment into a spindle-shaped trunk, often with suggestions of segmentation. Abdomen more or less distinct, 1-segmented; caudal rami much larger than in the female, armed with spines. Antennae, mouth parts, and swimming legs as in the female. A single species in this area.

HATSCHEKIA HIPPOGLOSSI (Krøyer)

FIGURE 285, *c*, *d*

Clavella hippoglossi KRØYER, Naturh. Tidsskrift, vol. 1, p. 205, pl. 2, 1837.

Hatschekia hippoglossi T. and A. SCOTT, The British parasitic Copepoda, p. 112, pl. 33, figs. 3, 4; pl. 34, figs. 8–11, 1913.

Occurrence.—Forty specimens, including both sexes, were taken from the gills of the halibut, caught off Nantucket Island, June, 1906.

Distribution.—European seas (Krøyer, Milne Edwards, Beneden); British Isles (T. and A. Scott); Iceland, Greenland (Hansen).

Color (preserved material).—Body a pinkish flesh color, oviducts darker, the contents of the digestive system almost black; ovisacs grayish white.

Female.—Body elongate, depressed; head wider than long; first segment forming a neck between the head and trunk; remainder of thorax fused with genital segment into a trunk five times as long as wide, with rounded lobes at the posterior corners. Between these lobes is the 1-segmented abdomen, about the same size as one of the lobes and not distinctly separated from the trunk. First antenna 5-segmented, sparsely setose; second antenna stout, its apical claw curved into a half circle. Second maxilla tipped with a stout claw and a circular pad, both fringed with minute hairs; maxillipeds elongated and slender, the apical claw nearly straight. Two pairs of biramose legs, rami 2-segmented. Total length, 6–8 mm. Egg strings, 10 mm. long.

Male.—Head larger than in the female, wider than the trunk, the frontal margin somewhat concave; first segment much narrower than the head and very short; trunk about twice as long as wide, with marginal indentations indicating segments. Abdomen wider than long; caudal rami much longer than those of the female, each apparently jointed near the center. Antennae, mouth parts, and swimming legs as in the female. Total length, 1–1.5 mm.

Remarks.—This is the largest species of the genus and has never before been reported from our American shores. It is rather common, however, upon the halibut around the British Isles and in the North Sea.

Genus DICHELESTHIUM Hermann, 1804

Female.—Head fused with first segment, strongly narrowed anteriorly; second and third segments produced laterally into short lobes, and with these lobes as wide as the carapace; fourth and fifth segments narrower and longer, tapered posteriorly, without lateral lobes; genital segment still narrower and longer, and tapered. Abdomen 1-segmented, attached to the ventral surface of the genital segment; caudal rami small and foliaceous. First antenna 8-segmented; second antenna cheliform; maxillipeds uncinate; first two pairs of legs biramose, rami 1-segmented (two segments fused); third legs uniramose, 1-segmented; fourth and fifth legs wanting.

Male.—Smaller than the female, head relatively larger, genital segment considerably shorter; no transverse grooves on the thoracic segments. Endopod of second leg very short and wide; third legs each a 1-segmented lamina wider than long, with a lobe at the end suggesting a second segment. A single species known.

DICHELESTHIUM OBLONGUM (Abildgaard)

Figure 286, *a*

Caligus oblongus Abildgaard, Skrivt. Naturh. Selsk., vol. 3, p. 52, 1794.
Dichelesthium oblongum T. and A. Scott, The British parasitic Copedoda, p. 106, pl. 31, figs. 7–18, pl. 45, figs. 4–5, 1913.

Occurrence.—Found in abundance on the gills of the sturgeon (*Acipenser sturio*) everywhere in the Woods Hole area.

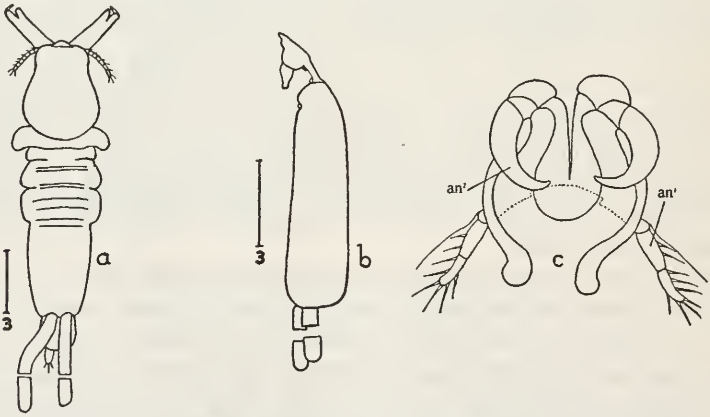

Figure 286.—*a. Dichelesthium oblongum*, female, dorsal (drawn by J. H. Blake, 1874); *b, Peniculus clavatus*, female, lateral; *c, P. clavatus*, first and second antennae

Distribution.—Rhine at Strassburg (Hermann, Desmarest); rivers of northern Europe (Latreille, Nordmann, Burmeister); British Isles (T. and A. Scott); Woods Hole, Vineyard Sound, Long Island Sound (Rathbun, Wilson).

Color.—Body a clear yellowish white, usually with a brownish tinge in the male; egg strings light brown.

Female.—Carapace rhomboid with rounded corners, narrowed anteriorly and posteriorly, posterior margin somewhat truncated; lateral lobes of second segment curved backward; fourth and fifth segments with transverse grooves near the center; genital segment with a transverse groove near the anterior end. Segments of first antenna subequal; second antenna very stout and extended diagonally forward, the segments indistinct; maxillipeds with a stout apical claw, shutting down against two small spines on the inner margin of the basal segment; legs armed with spines, no setae. Total length, 15–18 mm.

Male.—Smaller than female, the head relatively larger, the genital segment considerably shorter; no transverse grooves on the thoracic segments. Endopod of second legs very short and wide; third legs each a 1-segmented lamina wider than long, with a lobe at the end suggesting a second segment. Total length, 10–13 mm.

Remarks.—This parasite is apparently confined to the sturgeon, and remains upon its host as the latter migrates up the rivers of northern and central Europe. In the present area, however, it is a salt-water form.

Family LERNAEIDAE

Genus PENICULUS Nordmann, 1832

Female.—Head fused with the first segment, often showing lateral lobes, but without horns or processes; second and third segments narrowed, flattened dorsoventrally, and chitinized, forming a short neck; fourth segment widened and swollen; fifth and genital segments and abdomen fused into a cylindrical trunk; caudal rami minute, laminate, and armed with setae. First antenna filiform with few segments; second antenna strongly chelate; a long conical and retractile proboscis; mandibles and maxillae but no maxillipeds; basal plates only of the first four pairs of legs, the rami obsolete; no fifth legs. One species.

Male.—Unknown.

PENICULUS CLAVATUS (Müller)

FIGURE 286, *b*, *c*

Lernaea clavata MÜLLER, Zoologia Danica, p. 38, pl. 33, fig. 1, 1779.
Peniculus clavatus WILSON, Proc. U. S. Nat. Mus., vol. 53, p. 46, pl. 1, 1917.

Occurrence.—Taken from the fins of the rosefish (*Sebastes marinus*) captured off Cape Ann by the steamer *Speedwell* in 1878.

Distribution.—Coast of Norway (Müller, Olsson); Greenland (Krøyer); Davis Strait (Hansen).

Color (preserved material).—Head and neck a grayish yellow, trunk a dark cinnamon-brown; egg strings a lighter brown.

Female.—Cephalothorax subspherical, as wide as long; a blunt rostrum on the anterior margin; fourth segment two-thirds as wide as the trunk; the latter three and a half times as long as wide; egg strings one-fourth the width of the trunk and nearly twice the length of the body. First antennae 3-segmented; proboscis as long as the neck and narrowed distally; basal plates of the legs with a notch on the outer margin near the distal end. Total length, 7–9 mm.

Remarks.—This species has not yet been found within the present area, but Cape Ann is not far distant, and the host is a common fish around Woods Hole, which makes it very probable that the parasite will be found here soon.

Genus LERNAEENICUS LeSueur, 1824

Female.—Head fused with the thorax and furnished with slender cylindrical horns, 2 to 10 in number, simple or branched; thorax just behind head enlarged and furnished with four pairs of legs close together. Behind the legs the thorax becomes filiform and chitinous, twisted and usually flexed for half the body length or more. It then enlarges into a straight cylindrical trunk, and finally narrows into an abdomen; caudal rami minute or lacking; egg strings filiform and very long. Two pairs of antennae, second pair chelate; mandibles without teeth; only one pair of maxillae, no maxillipeds; first two pairs of legs biramose, third and fourth pairs uniramose, fifth pair lacking.

Male.—Unknown.

KEY TO THE SPECIES (FEMALES)

1. Head with 5 horns, cylindrical, chitinous, and branched or simple---------- 2
   Head with 2 lateral, or 1 dorsal, horns, short and unbranched------------ 3
2. Horns arranged radially in a single set; head in line with thorax; no attachment plates---------------------------- radiatus (p. 480)
   Horns arranged in 2 sets and branched; head at right angles to thorax; 4 attachment plates-------------------------- polyceraus (p. 481)
3. Two lateral horns; 4 attachment plates in front of antennae; abdomen much shorter than trunk----------------------- affixus (p. 482)
   One dorsal horn; no attachment plates; abdomen twice the length of trunk------------------------------------ longiventris (p. 483)

LERNAEENICUS RADIATUS (LeSueur)

FIGURE 287

Lernaeocera radiata LeSueur, Journ. Acad. Nat. Sci. Philadelphia, vol. 3, p. 288, pl. 11, 1824.

Lernaeenicus Wilson, Proc. U. S. Nat. Mus., vol. 53, p. 59, pls. 4, 5, 1917.

Occurrence.—Found with its horns buried in the flesh of various parts of the body of the tomcod (*Microgadus tomcod*), the menhaden (*Brevoortia tyrannus*), the mummichog (*Fundulus heteroclitus*), the eel (*Anguilla rostrata*), the bluefish (*Pomatomus saltatrix*), the blueback (*Pomolobus aestivalis*), the smelt (*Osmerus mordax*), the white hake (*Urophycis tenuis*), the alewife (*Pomolobus pseudoharengus*), the minnow (*Cyprinodon variegatus*), and the white perch (*Morone americana*). These fishes were all captured in or around Woods Hole.

Distribution.—North Atlantic (LeSueur, Milne Edwards); North American coast (Steenstrup and Lütken, Smith, Rathbun); Long Island Sound (Williams).

Color.—Head and proboscis blood red, neck light horn color, digestive canal red, trunk dark reddish black, ovaries and oviducts yellowish white; egg strings greenish yellow.

Female.—Head globular; proboscis as large as head and at right angles to it; horns filiform, radiating from dorsal surface of head and nearly equal in length, sometimes fewer than five, rarely more numerous and of different lengths. Neck threadlike and about half the entire length; trunk elongated-conical, the point of the cone at the base of the neck. Abdomen a short, stout, and blunt cone, on a level with the dorsal surface of the trunk, one-third as long and three-fourths as wide as the latter; no caudal rami. First antennae 3-segmented; second antennae 2-segmented, with apical chelae, rami of legs short, blunt, and destitute of spines or setae. Total length, 35–45 mm.

Remarks.—This is the commonest species of the genus around Woods Hole and is likely to be found upon other hosts than those mentioned. It can be identified by the five radiating, unbranched horns on the head, which are nearly always about the same length. Rarely there are only three horns and still more rarely there may be seven or even eight, in which case two are on the sides of the thorax posterior to the head.

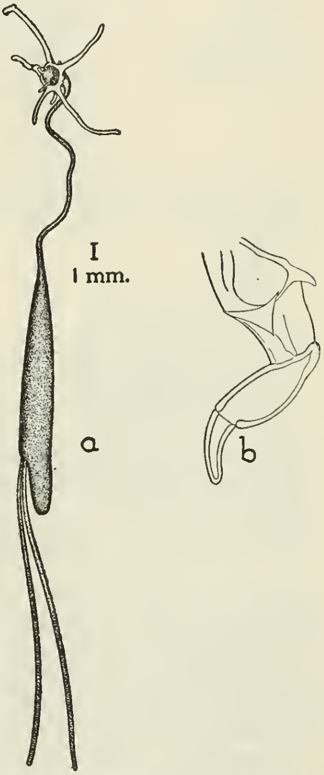

FIGURE 287.—*Lernaeenicus radiatus*: *a*, Female, lateral (drawn by Blake); *b*, female, second maxilla

LERNAEENICUS POLYCERAUS Wilson

FIGURE 288

Lernaeenicus polyceraus WILSON, Proc. U. S. Nat. Mus., vol. 53, p. 62, pl. 5, 1917.

Occurrence.—Fixed in the flesh of the tomcod (*Microgadus tomcod*), caught at Woods Hole in 1885.

Distribution.—Not found outside the present area.

Color.—Head blood red; neck and horns cartilage gray; trunk and egg strings brownish yellow.

Female.—Head bent forward at right angles to the thorax, with four attachment plates on the anterior margin (forehead) in front of the antennae. One pair of long branched lateral horns at the posterior margin of the head; another pair of lateral horns and an unpaired dorsal horn, all three dichotomously branched, on the thorax behind the fourth legs. Neck longer than the trunk and abdomen combined, flexed behind the horns and again where it joins the trunk, where also it is slightly enlarged. Trunk a short ellipsoid, flattened laterally; abdomen three-fifths as wide and nearly as long as the trunk. First antenna 3-segmented; second antenna 2-segmented, chelate; first three pairs of legs with a single ramus indistinctly segmented; fourth legs made up of the basal plates only, without rami. Total length, 10–12 mm. Egg strings, 8.5 mm. long.

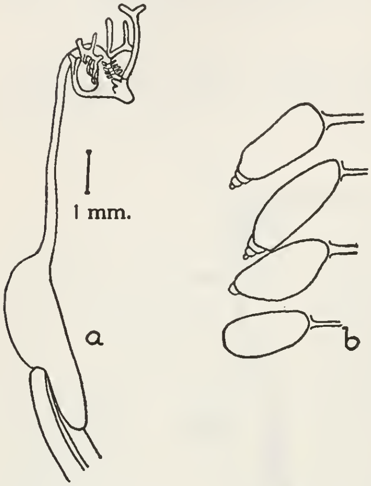

FIGURE 288.—*Lernaeenicus polyceraus*: *a*, Female, lateral; *b*, female, one of each of the four pairs of legs

Remarks.—This species can be identified by the branched horns and the attachment plates on the head; thus far it is confined to the single host.

LERNAEENICUS AFFIXUS Wilson

FIGURE 289

Lernaeenicus affixus WILSON, Proc. U. S. Nat. Mus., vol. 53, p. 64, pl. 6, 1917.

Occurrence.—Fastened to a bone or a bony fin ray in the tomcod, the mummichog, the white perch, and the blueback (*Pomolobus aestivalis*), all caught in or around Woods Hole.

Distribution.—Not found outside the present area.

Color (preserved material).—Body a uniform light orange-yellow; the head, neck, and egg strings brownish; the trunk often spotted with brown.

Female.—Head turned ventrally at right angles to the thorax, with four attachment plates on its anterior surface; no horns on the head, but a single pair, short and unbranched, on the sides of the thorax behind the fourth legs. Rarely these horns are branched, or there are two pairs close together. Neck slender, widening gradually at its posterior end into the trunk, which is longer than the neck and from ten to fifteen times as wide. The abdomen is three-fifths as wide and about one-third as long as the trunk; the caudal rami are tiny knobs, destitute of setae. First antenna 2-segmented; second antenna with one segment and an apical claw; first two pairs of legs biramose, rami 1-segmented; third leg with a basal plate and a single 1-segmented ramus; fourth leg with basal plate only, no ramus. Total length, 20–30 mm. Egg strings, 15–20 mm. long.

Remarks.—These parasites often bunch themselves on the throat of the tomcod, three or four using the same opening through the skin, but attaching their heads to different bones. This attachment to a bone and the single pair of horns, usually unbranched, are the distinguishing characters.

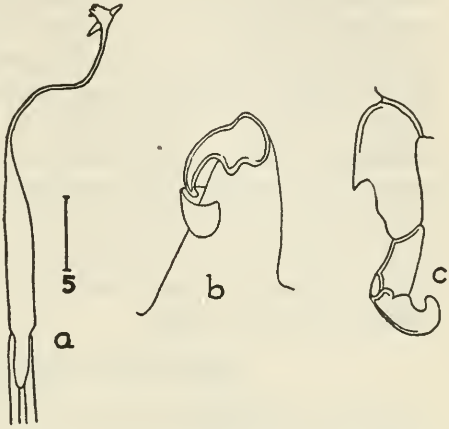

FIGURE 289.—*Lernacenicus affixus: a,* Female, dorsal; *b,* female, second antenna; *c,* female, maxilla

LERNAEENICUS LONGIVENTRIS Wilson

FIGURE 290

Lernaeenicus longiventris WILSON, Proc. U. S. Nat. Mus., vol. 53, p. 66, pl. 7, 1917.

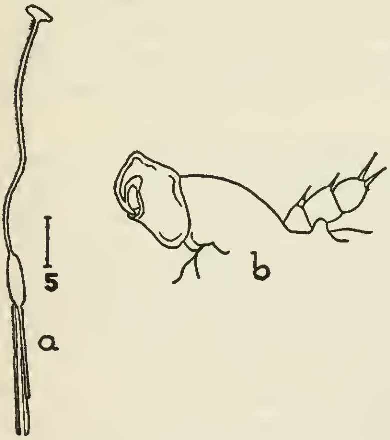

FIGURE 290.—*Lernaeenicus longiventris: a,* Female, lateral; *b,* female, first and second antennae

Occurrence.—From the flesh of the barrelfish (*Palinurichthys perciformis*), the bluefish (*Pomatomus saltatrix*), the Spanish mackerel (*Scomberomorus maculatus*), the crevalle (*Caranx hippos*), and the hardtail (*Caranx crysos*), all captured in and around Woods Hole.

Distribution.—From flesh of dolphin (*Coryphaena hippurus*), Atlantic Ocean southeast of Nantucket; gills of black drum (*Pogonias cromis*), at Norfolk, Va.; operculum of common mullet (*Mugil cephalus*), at Beaufort, N. C. (Wilson).

Color.—Body yellowish white, head a pinkish red, oviducts dark brown, egg strings a deep maroon.

Female.—Head at right angles to the neck, without horns but with three knobs, one posterior and two lateral. Neck much longer than trunk, decreasing in diameter backward; trunk cylindrical, the portion representing the genital segment one-fourth as long as the neck, four times as long as wide; the portion representing the abdomen filiform, half as long as the neck, thirty times as long as wide. First two pairs of legs biramose, third and fourth pairs uniramose, all the rami 2-segmented and armed with plumose setae. Total length, 40–50 mm. Egg strings, 10–15 mm. long.

Remarks.—The head of this parasite is buried close to the backbone of its host and is surrounded by a fibrous membrane or sheath so tough that it is seldom removed without injury to the parasite's head. Unlike the preceding species, there is rarely more than a single specimen on each host, usually at one side of the dorsal or ventral fin near the tail.

Genus SARCOTRETES Jungersen, 1911

Female.—Head fused with the first segment and in line with the body axis, armed with two large and soft lateral horns turned backward and tipped with a single dactylose process. Neck constricted behind the horns, then enlarged, then narrowed a second time where it joins the trunk, and usually more or less flexed. Trunk claviform and squarely truncated posteriorly, the abdomen a mere knob on the dorsal surface at the posterior end; no caudal rami. First antenna with few segments; second antenna chelate; two pairs of maxillae; no maxillipeds; first two pairs of legs biramose, third pair uniramose, rami all 2-segmented and armed with plumose setae; fourth and fifth legs lacking.

Copepodid male.—Head fused with first segment, three times as long as wide; second, third and fourth segments free; fifth and genital segments and abdomen fused into a trunk without lobes; caudal rami short and wide, each with four or five nonplumose setae. First two pairs of legs like those of the female, biramose, rami 2-segmented; third legs uniramose, rami 1-segmented; fourth and fifth legs lacking. One species.

SARCOTRETES LOBATUS Wilson

FIGURE 291

Sarcotretes lobatus WILSON, Proc. U. S. Nat. Mus., vol. 53, p. 72, pl. 8, 1917.

Occurrence.—Found buried in the flesh of the deep-sea lantern fish (*Benthosema mülleri*), captured off Marthas Vineyard and off Block Island, 1885.

Distribution.—Not found outside the present area.

Color (preserved material).—Body a brownish yellow, darker on the cephalothorax and trunk, lighter on the neck.

Female.—Head cylindrical and strongly inflated; horns also inflated and cushionlike; neck behind the horns showing the two anterior terga and sterna, then narrowing gradually and becoming chitinized, and flexed ventrally where it joins the trunk. First antenna 1-segmented, rather well supplied with setae; second antenna 3-segmented, with a stout apical chela; proboscis cylindrical and strongly protrusible; first maxilla a tiny process tipped with two setae; second maxilla 3-segmented, uncinate. Total length, 22 mm.

Male.—Unknown.

Remarks.—This species can be recognized by the cushionlike horns, each ending in a finger process, and thus far it has been found only on the one host.

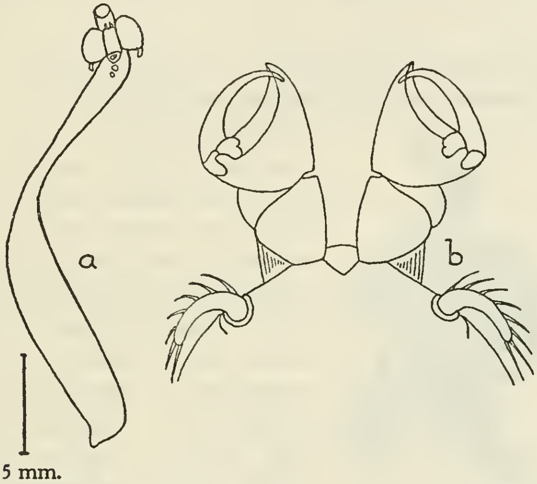

FIGURE 291.—*Sarcotretes lobatus: a,* Female, dorsal; *b,* female, first and second antennae

Genus LERNAEOCERA Blainville, 1822

Female.—Head fused with the first segment, globular, and armed with three branched chitin horns, one dorsal and two lateral; second, third, and fourth segments fused into a slender neck, the same diameter throughout; fifth and genital segments and abdomen fused into a swollen trunk, bent into the shape of the letter S; caudal rami minute, each tipped with a single seta. Egg strings filiform, many times the length of the body and irregularly coiled. First antenna 3-segmented and setose; second antenna 2-segmented and chelate; two pairs of maxillae, no maxillipeds; first two pairs of legs biramose, third and fourth legs uniramose, all rami 2-segmented.

Copepodid male.—Head fused with first segment; second, third, and fourth segments free; fifth and genital segments fused; abdomen 1-segmented, caudal rami short and wide, each tipped with four or five setae. First antenna 4-segmented and setose; second antenna chelate; two pairs of maxillae and a pair of stout maxillipeds; swimming legs like those of the female. A single species in the area.

LERNAEOCERA BRANCHIALIS (Linnaeus)

FIGURE 292

Lernaea branchialis LINNAEUS, Systema naturae, ed. 12, vol. 1, p. 1092, 1767.

Lernaeocera branchialis WILSON, Proc. U. S. Nat. Mus., vol. 53, p. 85, pls. 10, 12. 17, 1917.

Occurrence.—Fastened to the gill arches of the common cod, captured in and around Woods Hole.

Distribution.—European coasts (Linnaeus, Müller, Blainville, Nordmann, Krøyer); British Isles (Baird, Thompson, T. and A. Scott); Greenland (Steenstrup and Lütken); Iceland (Hansen); Denmark, Sweden, Norway (Krøyer, Hansen); coast of Maine (Wilson).

Color.—Body dark reddish brown, becoming yellow in preservatives; horns dark brown; egg strings orange-yellow.

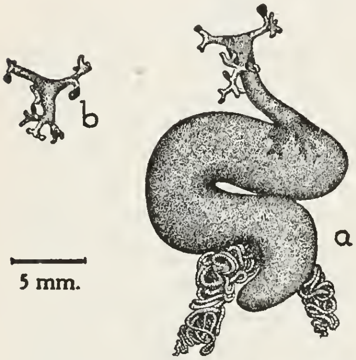

FIGURE 292.—*Lernaeocera branchialis*: *a*, Female, lateral (drawn by Blake); *b*, female, horns, dorsal view

Female.—The dorsal horn longer than the lateral ones, all three profusely branched, the tips of the branches usually swollen. Neck often wrinkled transversely; trunk considerably elongated and bluntly rounded. Head turned forward at right angles to the neck, so that the proboscis when protruded is parallel with the axis of the neck. The first two pairs of legs are close together, the third and fourth pairs are separated a little, the fifth pair is obsolete. Total length, 30–40 mm. Egg strings, 150–200 mm. long.

Remarks.—If found at all the males will be only 1 mm. long and perfectly free, darting about over the gill filaments of their host. They have been found on the gills of the plaice and the lumpfish in European waters but have never been reported from our American shores. They must be present, however, upon some convenient host, and will probably be found in the near future. The female can be recognized by its large size and the S-shaped curve of the trunk.

Genus LERNAEOLOPHUS Heller, 1865

Female.—Head fused with first segment and turned forward at right angles to the neck axis, and armed with three horns, one dorsal and two lateral. Neck cylindrical, stout, attached to the trunk on the midline, and showing more or less torsion. Trunk bent in a sigmoid curve, the walls of both neck and trunk heavily chitinized;

abdomen with two rows of dichotomously branched processes along either side and rudiments of caudal rami. First antenna 1-segmented; second antenna chelate; mouth parts replaced by small knobs; first two pairs of legs biramose, third and fourth pairs uniramose, all rami 2-segmented; fifth legs lacking. Egg strings in a loose irregular coil. One species in this area.

Male.—Unknown.

LERNAEOLOPHUS SULTANUS (Nordmann)

FIGURE 293.

Pennella sultana NORDMANN, Bull. Soc. Imp. Nat. Moscow, vol. 37, pt. 2, p. 485, pl. 5, 1864.

Lernaeolophus sultanus WILSON, Proc. U. S. Nat. Mus., vol. 53, p. 91, pl. 13, 1917.

Occurrence.—Found on the gill arches of the orange file fish (*Alutera shoepfii*) and on the upper jaw inside the mouth of the garfish (*Tylosurus marinus*), both hosts captured in Vineyard Sound.

Distribution.—From the common grunt (*Haemulon plumieri*) at Tortugas, Fla. (Wilson).

Color (preserved material).—Body a uniform reddish brown.

Female.—Cephalothorax spherical, divided on the anterior and ventral surfaces into two pads by a shallow median groove, each pad produced ventrally into three dactylose processes. Posterior end of head armed with one dorsal and two lateral horns, all more or less branched. Walls of the neck and trunk very hard and thick chitin; neck the same diameter throughout, trunk twice as wide. Abdomen on a level with the dorsal surface of the trunk, its lateral processes dichotomously branched, those in the two rows on each side alternating with each other. Rami of legs often broken off, well armed with setae. Total length, 12–15 mm.

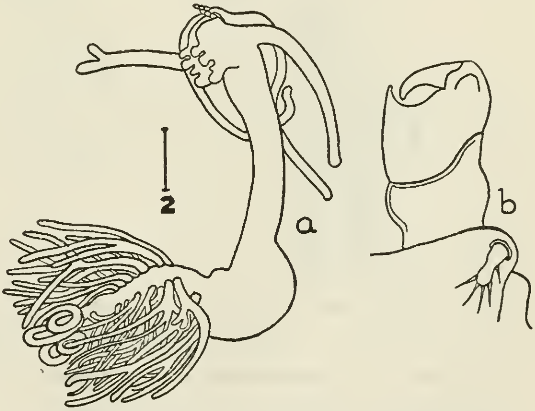

FIGURE 293.—*Lernaeolophus sultanus: a,* Female, lateral; *b,* female, first and second antennae

Remarks.—The distinctive characters of this parasite are the heavy chitinization of the entire body and the two rows of branched processes on each side of the abdomen. These processes are often thickly covered with algae and protozoa and are more profusely branched in the older and larger individuals.

Genus HAEMOBAPHES Steenstrup and Lütken, 1861

Female.—Head fused with first segment, subspherical and produced laterally into cushionlike processes; second, third, and fourth segments distinctly separated and usually produced laterally into cushion processes, those on the second and third segments entire, those on the fourth segment bilobed; fifth segment forming a long, slender, and cylindrical neck, flexed in front of the center and armed with short chitin horns. Trunk much swollen and bent into a sigmoid curve, with a pair of processes on each side over the bases of the egg strings; abdomen not separated from the genital segment; caudal rami lacking. First antenna 3-segmented; second antenna chelate; first two pairs of legs biramose, rami 2-segmented; third and fourth pairs uniramose, rami 1-segmented. A single species here.

Male.—Unknown.

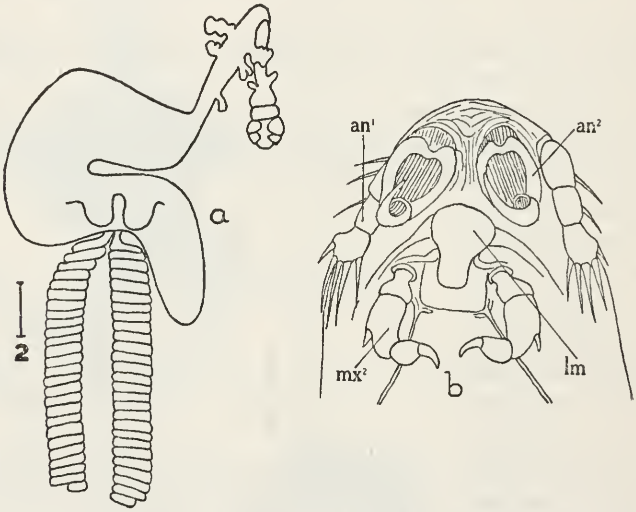

FIGURE 294.—*Haemobaphes cyclopterina: a,* Female, lateral; *b,* female, antennae and mouth parts

HAEMOBAPHES CYCLOPTERINA (Fabricius)

FIGURE 294

Lernaea cyclopterina FABRICIUS, Fauna Groenlandica, p. 387, 1780.

Haemobaphes cyclopterina WILSON, Proc. U. S. Nat. Mus., vol. 53, p. 95, pl. 14, 1917.

Occurrence.—Found on the gills of the wolf eel (*Lycenchelys verrillii*), captured in the Gulf of Maine east of Cape Cod.

Distribution.—Greenland (Fabricius, Müller, Stephensen); British Isles (T. and A. Scott); Iceland (Steenstrup and Lütken); Faroe Islands (Hansen); coast of Korea (Wilson).

Color (preserved material).—Head, soft part of neck, and body grayish yellow; hard chitinous part of neck and egg strings orange-yellow.

Female.—Head and neck in front of flexure soft, rest of body hard; dorsal surface of head with central longitudinal ridge, two lateral cushionlike processes projecting ventrally, and in front of them two other cushionlike processes on the ventrolateral surface, also projecting ventrally. Second and third segments nearly as wide as head; fourth segment abruptly narrowed to half that width at the anterior end, but widened posteriorly. First antenna 3-segmented; second antenna 2-segmented, tipped with a chela; first maxillae apparently lacking; second maxillae 3-segmented, uncinate. First two pairs of legs biramose, rami 2-segmented; third and fourth legs not found on any specimen thus far examined. Total length, 30–40 mm. Diameter of trunk, 4 mm. Egg strings, 125 mm.

Remarks.—This species can be identified by the sigmoid curve of the body, the lateral processes of the head, and first two thoracic segments, and the spirally coiled egg strings. The sharp flexure of the neck makes it very difficult to dissect the head and anterior thorax out of the blood vessel in which they are immersed. In consequence most investigators have never seen the parasite's head.

Family PENNELLIDAE

Genus PENNELLA Oken, 1816

Female.—Head fused with first segment and more or less globular, usually somewhat flattened dorsoventrally, the anterior end truncated and covered with short tumid processes, the posterior end armed with two or three unbranched horns, usually chitinous. Neck long, cylindrical, and passing insensibly into the trunk, which is straight and transversely ridged. Abdomen long, distinctly annulated, and tapered to a bilobed tip, with a row of plumose appendages along each side nearer the ventral surface, and a pair of minute caudal rami with long setae. Egg strings filiform, several times the length of the body. First antennae with few segments; second antennae chelate; mouth parts obsolete; first two pairs of legs biramose, close together; third and fourth pairs removed a short distance, uniramose, all rami 2-segmented and setose.

Copepodid male.—Head fused with first segment; second, third, and fourth segments free and diminishing in width; fifth and genital segments fused; abdomen 1-segmented, caudal rami short and wide and setose. First antennae indistinctly segmented; second antennae 2-segmented with a stout chela; mandibles, two pairs of maxillae and a pair of maxillipeds present and well developed; swimming legs like those of female; no fifth legs.

KEY TO THE SPECIES (FEMALES)

1. Two or three horns, very short and stout, at right angles to head; papillae uniform in size and distribution__________________ filosa (p. 490)
   Two or three horns, long and soft and pointed backward__________________ 2
2. Head longer than wide, with concave lateral margins; horns parallel with neck; papillae in definite areas only______ instructa (p. 491)
   Head wider than long, with convex lateral margins; horns diagonal to the neck; papillae uniformly distributed____ orthagorisci (p. 492)

PENNELLA FILOSA (Linnaeus)

FIGURE 295, *a, b*

Pennatula filosa LINNAEUS, Systema naturae, p. 819, 1758.
Pennella filosa WILSON, Proc. U. S. Nat. Mus., vol. 53, p. 119, pls. 15–17, 1917.

Occurrence.—Found with head and neck buried in the flesh of the swordfish, and of the sunfish, captured off Marthas Vineyard.

Distribution.—Mediterranean (Linnaeus, Ellis, Cuvier, Leigh-Sharpe); British Isles (Norman, T. and A. Scott); Atlantic coast off New Jersey (Leidy, Fowler); North Atlantic (Brian); Vineyard Sound (M. T. Thompson, Rathbun); Nova Scotia (Wilson).

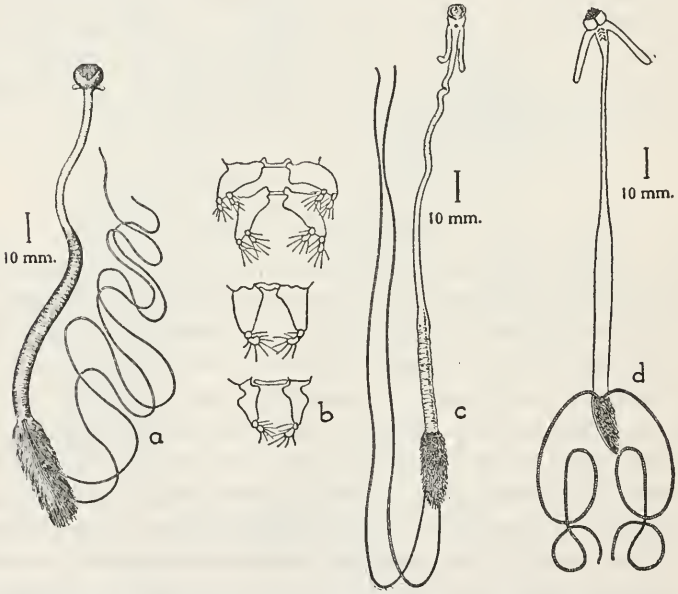

FIGURE 295.—*a, Pennella filosa,* female, dorsal; *b, P. filosa,* four pairs of legs; *c, P. instructa,* female, ventral (*a* and *c* drawn by Blake); *d, P. orthagorisci,* female, ventral

Color.—Head and neck pale yellow, often with a reddish tinge; trunk dark cinnamon-brown, banded transversely with yellow; egg strings dark orange-yellow, the color becoming deeper with development.

Female.—Head wider than long, squarely truncated anteriorly, the truncated surface covered with tumid papillae of uniform size and even distribution; a pair of short, stout, unbranched lateral horns and often a third dorsal horn half as wide, all three standing out nearly at right angles at the posterior end of the head. Neck the same diameter throughout and varying greatly in length; the trunk twice as wide as the neck and transversely ridged; the abdomen slightly less than half the length of the trunk, its plumes usually profusely branched. Egg strings twice the body length or more. First antennae 3-segmented; second antennae 2-segmented; mandibles, two pairs of maxillae, and the rudiments of maxillipeds present in young females but disappearing in adults. Intervals between the successive pairs of legs in the proportion of 10:30:35. Total length, 150–200 mm. Egg strings, 300–350 mm. long.

Remarks.—This species is common and may be distinguished by the characters given in the key. The portion of the body outside of the skin of the host affords lodging for algae, hydroids, and often goose barnacles, and is sometimes completely covered with them.

PENNELLA INSTRUCTA Wilson

FIGURE 295, *c*

Pennella instructa WILSON, Proc. U. S. Nat. Mus., vol. 53, p. 122, pl. 18, 1917.

Occurrence.—Found buried in the flesh of the common swordfish captured off Marthas Vineyard and Nantucket.

Distribution.—Not found elsewhere.

Color.—Head and neck brownish yellow; trunk dark cinnamon-brown, with interrupted transverse bands of yellow; plumose appendages dark steel gray; egg strings brownish yellow.

Female.—Head longer than wide, squarely truncated anteriorly, the tumid papillae not covering the truncated surface, but arranged in a pattern, leaving much of the surface bare; lateral margins of head concave. Horns long, soft, and bluntly pointed, extending backward parallel with the neck and close to it; never more than two horns. Neck twice the length and half the width of the trunk, and usually more or less bent and twisted. Trunk transversely ridged; abdomen half as long as trunk; plumules 24 in number on each side and dichotomously branched. First antennae 4-segmented, heavily armed with setae; second antennae 2-segmented; intervals between the successive pairs of legs in the proportion of 1:5:6. Total length, 200–250 mm.

Remarks.—This species is confined to the swordfish, into the flesh of which it burrows until the copepod's head is brought into contact with the fish's dorsal aorta. Around the head and neck of the parasite is formed a tough cyst, which is often 2 inches or more in diameter.

PENNELLA ORTHAGORISCI Wright

FIGURE 295, *d*

Pennella orthagorisci WRIGHT, Ann. Mag. Nat. Hist., ser. 4, vol. 5, p. 43, pl. 1, 1870.—WILSON, Proc. U. S. Nat. Mus., vol. 53, p. 124, 1917.

Occurrence.—Taken by Rathbun from the flesh of a sunfish captured in Vineyard Sound.

Distribution.—British Isles (Wright, T. and A. Scott, Norman); South Africa (Stebbing); North Atlantic (Steenstrup and Lütken, Brian).

Color.—Head and horns light brown, trunk dark olive-brown, the grooves between the transverse ridges lighter; plumose appendages a deep black; egg strings grayish white.

Female.—Head wider than long, rarely twice as wide, its lateral margins convex; anterior end flattened and inclined ventrally; papillae numerous and very small, covering not only the end but some of the sides of the head; two horns extending diagonally outward, tapered to a blunt point. Neck shorter and half as wide as the trunk, which is ridged transversely; abdomen two-fifths as long as trunk, its plumules profusely branched and directed backward. First antennae indistinctly 3-segmented; second antennae 2-segmented; intervals between the successive pairs of legs in the proportion of 1:4:4. Total length, 150–200 mm. Egg strings, 125–150 mm. long.

Remarks.—This species may be identified by the width of the head and the short abdomen. The abdominal plumes are also all turned downward and backward, leaving the dorsal surface of the abdomen uncovered.

Suborder LERNAEOPODOIDA

Body of both sexes usually rigidly fused and showing no movable articulation and often no trace of segmentation; with or without dorsal, lateral, or posterior processes. Sexual dimorphism universally present, resulting in great disparity of size between the sexes and a corresponding dissimilarity in structure. Carapace often present, but never any paired dorsal plates as in the Caligoida.

Proboscis short and blunt, more often lacking; first antennae minute and with only a few segments; second antennae very small, uniramose or biramose, sometimes prehensile. Second maxillae in the female often modified into cylindrical "arms," united at their tips to the pedicel of an attachment bulla. This is the mode of attachment in the type family of the group, the Lernaeopodidae, but many genera have no second maxillae, and sometimes when present they are not prehensile. In genera using this mode of attachment the maxillipeds migrate forward more or less during development and in the adult often stand in front of the second maxillae. The swimming legs are more often lacking in the female, but one or two pairs are usually present in the male. In several genera all segmented appendages are obsolete, and in one or two there is also no distinction of body regions.

Two ovisacs, club shaped, spherical, or cylindrical; eggs multiseriate and pressed so tightly together that they are flattened into polygons; nauplius and often metanauplius stages passed within the egg, the larva emerging in the first copepodid stage and attaching itself at once to its host by means of a frontal filament. The female becomes a fixed parasite attached immovably to its host, the male clings to the female and can crawl about more or less over her body.

Remarks.—Although the male is a pygmy and is usually identified by the female to which it is attached, it does furnish useful generic characters and for this reason the males appear in the key (Appendix B, p. 538) as well as the females. Every genus in the group is a fixed parasite and all kinds of modification, transformation, and degeneration are exhibited among them. The ultimate limit is apparently reached in the genus *Xenocoeloma* where nothing is left in the adult except the posterior portion of the digestive tract and two ovisacs, and the copepod has become hermaphroditic.

Family CHONDRACANTHIDAE

Genus BLIAS Krøyer, 1863

Female.—Head separated from the trunk by a groove, which extends entirely around the body; remainder of thorax and genital segment fused into a smooth trunk without appendages or processes; abdomen separate, much reduced in size, 2-segmented, with caudal rami. First antennae with few segments; second antennae prehensile; mouth parts near posterior margin of head and made up of mandibles and two pairs of maxillae; swimming legs lacking.

Male.—A pygmy attached to the female by its second antennae; body pyriform, distinctly segmented, with two pairs of antennae, 4 pairs of mouth parts, and two pairs of rudimentary legs. A single species in the present area.

BLIAS PRIONOTI Krøyer

FIGURE 296, *a*

Blias prionoti KRØYER, Naturh. Tidsskrift, ser. 3, vol. 2, p. 262, pl. 12, fig. 5, 1863.

Occurrence.—Two females were taken from the gills of a sea robin (*Prionotus*) at Woods Hole, June, 1904.

Distribution.—Coast of Brazil (Krøyer).

Color.—This copepod has never been seen alive; preserved specimens are a uniform yellowish brown.

Female.—Head spherical, one-third the length of the trunk; basal segment of abdomen four times as long as anal segment; caudal rami a little longer than the anal segment and curved like parentheses; ovisacs half as long again as the entire body. First antennae 3-segmented; second antenna 2-segmented, the distal segment with a stout apical claw; maxillae also tipped with claws. Total length, 2 mm. Egg strings, 3 mm. long.

Male.—Cephalic segment considerably swollen and half the entire length, the rest of the body divided into five segments of about equal length, the thorax passing insensibly into the abdomen. The caudal rami are longer than the anal segment, slender, and setiform; the maxillipeds are made up of three segments and a slender apical claw. Total length, 0.5 mm.

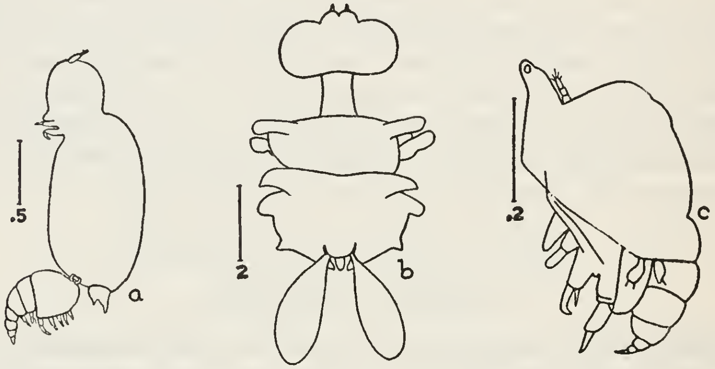

FIGURE 296.—*a, Blias prionoti,* female, with male, lateral (after Krøyer); *b, Oralien triglae,* female, dorsal; *c, O. triglae,* male, lateral

Remarks.—Krøyer's original description from a specimen found on the gills of a *Prionotus* (sea robin) in the Vienna Museum is the only one that has ever appeared. That fish came from the coast of Brazil, and hence this is the first record of the parasite on North American shores.

Genus ORALIEN Bassett-Smith, 1899

Female.—Head swollen and bulblike anteriorly, where it is armed with two pairs of antennae, narrowed and elongated posteriorly into a cephalic neck, which is slightly enlarged where it joins the thorax, and carries there the mouth and mouth parts. Thorax fused, enlarged laterally and more or less depressed; divided by a transverse constriction into two portions, the anterior of which carries two pairs of leg rudiments, the posterior a pair of lobes at the distal corners. Abdomen small, 1-segmented; caudal rami lacking.

Male.—Head fused with the first two thoracic segments and bearing all the appendages except the caudal rami; trunk with five distinct segments; caudal rami setiform. First antenna 3-segmented; second antennae, second maxillae, and maxillipeds stout and prehensile; both pairs of legs uniramose, 1-segmented. A single species.

ORALIEN TRIGLAE (Blainville)

FIGURE 296, *b*, *c*

Lernentoma triglae BLAINVILLE, Journ. Phys., vol. 95, p. 441, pl. 62, fig. 12, 1822.
Oralien triglae OAKLEY, Parasitology, vol. 19, no. 4, p. 460, figs. 3–7, 1927.

Occurrence.—A single female was taken from the gills of a gurnard captured off Marthas Vineyard.

Distribution.—British coasts (Bassett-Smith, T. Scott, Leigh-Sharpe); Mediterranean (Brian, Milne Edwards).

Color.—Body of preserved specimens pale yellowish gray; ovisacs dark brown.

Female.—Head obcordate and depressed; neck a little shorter than the trunk; anterior portion of trunk with two pairs of tripartite rudimentary legs on the ventral surface and two pairs of dorsolateral processes. Posterior portion with two pairs of lateral processes and a pair of posterior lobes curved inward. First antennae 1-segmented, obpyriform; second antennae 2-segmented, with slender apical claw; end segment of second maxilla spinelike, its outer margin toothed; maxillipeds 2-segmented, with a slender terminal claw. Total length, 7 mm.

Male.—Cephalic segment considerably more than half the entire length and much swollen; trunk segments diminishing regularly in size backward; the last segment alone representing the abdomen. First leg a flat lamina, with two apical setae and an anterior lobe, tipped with a single spine; second leg also a flat lamina, with a single posterolateral spine. Total length, 0.6 mm.

Remarks.—This genus and species have been badly confused with two other genera, *Lernentoma* Blainville and *Medesicaste* Krøyer, but Oakley, in the reference given above, has separated the three and given useful diagnoses.

Genus PSEUDOCHONDRACANTHUS Wilson, 1908

Female.—Head distinctly separated from first segment, with a small dorsal carapace; first segment free, the others, including the genital segment, fused into an elongate body without any traces of segmentation; abdomen small, 2-segmented. Mouth parts near the posterior margin of the head and similar to those of *Chondracanthus;* a single pair of leg rudiments, uniramose, bilobed at the tip.

First antennae 1-segmented; second antennae sickle-shaped claws; maxillipeds greatly enlarged, their basal segments covering the other mouth parts; ovisacs cylindrical.

Male.—Head fused with first segment and much larger than the rest of the body, and covered with a carapace; trunk very indistinctly segmented; no abdomen; caudal rami long conical processes, divided distally; no leg rudiments; antennae and mouth parts like those of female, the maxillipeds relatively as large. A single species in the present area.

PSEUDOCHONDRACANTHUS DICERAUS Wilson

FIGURE 297, *a*, *b*

Pseudochondracanthus diceraus WILSON, Proc. U. S. Nat. Mus., vol. 35, p. 436, pl. 67, figs. 11–17, 1908.

Occurrence.—Both sexes were taken from the gills of the common puffer (*Sphoeroides maculatus*) at Woods Hole, July, 1906.

Distribution.—La Jolla, Calif. (Wilson).

Color.—Body the color of transparent cartilage, except the coiled oviducts, which are white and opaque; eggs white, ripening into rose-red or pink.

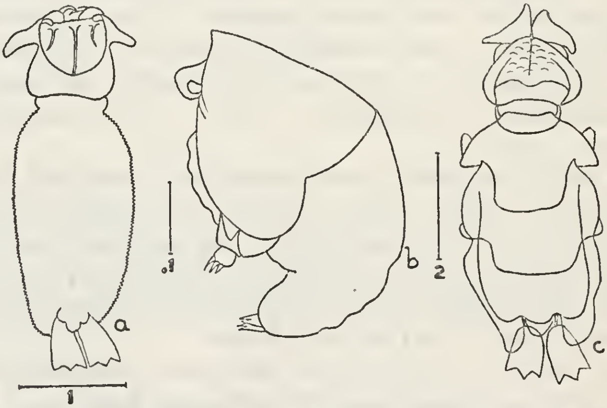

FIGURE 297.—*a*, *Pseudochondracanthus diceraus*, female, dorsal; *b*, *P. diceraus*, male, lateral; *c*, *Chondracanthus cottunculi*, female, dorsal (after Rathbun)

Female.—Head with a short blunt horn at each anterior corner, extending laterally; first antennae swollen at the base, narrowed distally, with two apical setae; basal segments of second antennae telescoped so that the claws seem directly articulated with the head. Basal portion of maxilliped a flattened lamina, distal portion bipartite, the outer part with a stout apical claw, the inner part covered with short spines. Total length, 3 mm.

Male.—Carapace 3-lobed, the central lobe dorsal, the others lateral; body with marginal sinuses indicating segments but without any transverse grooves. First antennae 1-segmented; second antennae with a stout apical claw; basal portion of maxilliped a flat lamina as in the female, but the terminal portion is a single flat segment, with an apical fringe of hairs and a large spine at the outer corner. Total length, 0.43 mm.

Remarks.—This genus can be identified by the presence of only one pair of leg rudiments on the first segment, and a pair of horns at the anterior corners of the head, and by the absence of all paired processes.

Genus CHONDRACANTHUS La Roche, 1811

Female.—Head small, separated from the thorax by a more or less clearly defined constriction; first and second segments usually free and narrower than the head and the posterior body; the remaining segments fused with the genital segment into a trunk, indistinctly divided near its center and produced at its posterior corners, and ventrally or laterally, into paired processes. Abdomen very small, 1- or 2-segmented; no caudal rami. First antennae usually fleshy; second antennae prehensile; mouth parts removed to the posterior margin of the head; mandibles falciform; end segment of maxilla spinelike, toothed on its outer margin; two pairs of biramose legs, rami very rudimentary.

Male.—Head more or less fused with first segment and much larger than the rest of the body; second segment free and carrying the second pair of legs; trunk 4-segmented; caudal rami well developed, conical; two pairs of uniramose, 1-segmented legs, each ramus cylindrical with two apical setae, sometimes laminate with an anterior process.

KEY TO THE SPECIES (FEMALES)

1. Head much wider than long, posterior corners smoothly rounded; third segment processes invisible dorsally____________ **cottunculi** (p. 497)
   Head much longer than wide, with short, fleshy horns at posterior corners; third segment processes visible dorsally__ **merlucii** (p. 498)

CHONDRACANTHUS COTTUNCULI Rathbun

FIGURE 297, *c*

Chondracanthus cottunculi RATHBUN, Proc. U. S. Nat. Mus., vol. 9, p. 322, pl. 11, 1886.

Occurrence.—Taken from the gill cavity of two deep sea sculpins (*Cottunculus thomsonii* and *C. microps*) by Rathbun off Georges Bank in 1883.

Distribution.—Not found outside the present area.

Color (preserved material).—Body yellowish white or light flesh color, the oviducts a dull yellow.

Female.—Body about twice as long as wide; head considerably wider than long, narrowed anteriorly, with a rounded knob at each corner, terminating posteriorly in a raised border. First segment forming a short neck; second segment twice as wide as first, with winglike lateral processes; third, fourth, and fifth segments more or less fused, a pair of processes on the ventral surface of the third segment, and another at the posterior corners of the fifth segment. Genital segment as wide as long; abdomen 1-segmented, globular. First antennae 1-segmented, triangular, very fleshy; second antennae uncinate. Each leg of the first two pairs consists of a fleshy lamina, enlarged and indented at its tip. Total length, 6 mm.

Male.—Unknown.

Remarks.—This species may be recognized by the fleshy triangular antennae, and by the lateral wings on the second segment. The two hosts frequent the continental shelf and slope off southern New England.

CHONDRACANTHUS MERLUCCII (Holten)

PLATE 1, *a*; FIGURE 298

Lernaea merluccii HOLTEN, Skrivt. Natur. Selsk., vol. 5, Heft 2, p. 135, pl. 3, 1802.
Chrondracanthus merluccii T. and A. SCOTT, The British parasitic Copepoda, p. 180, pl. 20, fig. 10, pl. 47, fig. 8, pl. 53, figs. 16–19, 1913.

Occurrence.—Numerous specimens have been taken from the mouth and gill cavity of the silver hake (*Merluccius bilinearis*), at Woods Hole, at Marthas Vineyard, off Block Island, and in Vineyard Sound.

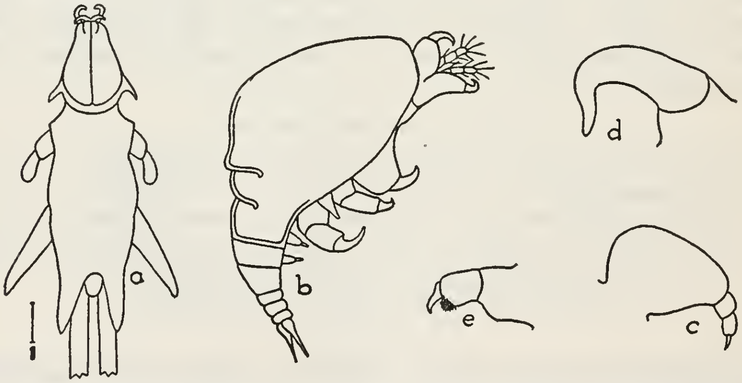

FIGURE 298.—*Chondracanthus merluccii: a,* Female, dorsal; *b,* male, lateral; *c,* female, first antenna; *d,* female, second antenna; *e,* female, second maxilla

Distribution.—British seas (T. and A. Scott); North Sea (Timm); Mediterranean (Heller, Valle, Carus, Brian); northern Atlantic (Goode); Woods Hole (M. J. Rathbun); Casco Bay, Me., and the fish market at Washington, D. C. (Wilson).

Color.—Body a clear opaque white when alive, on account of the presence inside the body of numerous small spherical masses of mesenchyme. The head is pink, the region around the digestive canal and the spaces between the mesenchyme masses are translucent. The canal itself and the pockets it sends out laterally are brownish or reddish. The eggs are at first white but become pink or red upon ripening.

Female.—Head trapezoidal, wider behind than in front, one-half longer than wide, the front margin evenly rounded, the carapace divided dorsally by a median longitudinal line. In profile the head slopes upward and backward and is distinctly gibbous behind, with a soft horn or barb at each postero-lateral corner. First two segments free bearing the swimming legs; second segment considerably wider than the first, its anterior lateral corners produced forward into small knobs. Last three segments fused, with an indistinct groove across the center, a pair of long processes on the ventral surface of the third segment, and a shorter pair at the posterior corners of the fifth segment. Just in front of the genital segment on the midline of the ventral surface is a small knob; the genital segment is thick, somewhat flattened, and divided longitudinally by a ventral transverse groove; there are no processes or prolongations on this segment in these American specimens.

First antennae with a fleshy, triangular basal segment and one or two subspherical distal segments; second antennae enormous sickle-shaped claws. Mandibles falcate with exceptionally large teeth; maxillae with a papillate palp and a fringe of large teeth; terminal claw of maxilliped toothed on its inner margin. Each swimming leg consists of a laminate basal segment and two rami; on the first legs these rami are very small and more or less fused with the basal segment, on the second legs they are long and well separated. Total length, 7–12 mm. Egg strings, 12–14 mm.

Male.—Head separated dorsally from, but fused ventrally with, the first segment, very much larger than the rest of the body and considerably inflated dorsally. Trunk more or less distinctly segmented, especially toward the tip; caudal rami conical, enlarged at the base and acuminate at the tip. First antennae slender and 3-segmented; second antennae made up of a single segment with a very stout apical claw; mouth parts similar to those of the female. Each leg consists of a single lamina tipped with a short spine, with another spine on the outer margin nearer the tip; on the inner margin at the base is a well-defined lobe with an apical spine. Total length, 0.4–0.55 mm.

Remarks.—Within the present area this species is apparently confined to the silver hake, or whiting, and almost every fish yields some of the parasites. A. C. Weed obtained about 50 females, most of which had at least one male attached, from the mouth of the same fish in the public fish market, Washington, D. C., January 5, 1909. This indicates that the parasite remains on its host through the winter, and practically all these females carried ovisacs. Often the place of attachment is swollen into a papilla of soft puslike consistency, in which the head and part of the thorax of the copepod are immersed.

Genus ACANTHOCHONDRIA Oakley, 1927

Female.—Head separated from the first segment; first two segments free and bearing the two pairs of swimming legs; the last three segments fused into a trunk which may be unsegmented, or may be segmented once near its center. One pair of processes at the posterior corners of the trunk, but no dorsal or ventral processes and no cephalic barbs. Urosome small, 2-segmented; no caudal rami. First antennae fleshy, usually 2-segmented, the distal segment a small knob armed with short spines; second antennae stout curved claws; mandible falcate, toothed on both margins; maxilla spiniform, with or without a palp; two pairs of uniramose cylindrical legs, usually bilobed at their tips; sometimes biramose, rami rudimentary.

Male.—Head fused with the first two thoracic segments and bearing all the appendages except the caudal rami; trunk 4-segmented, anal segment very thick; caudal rami short, spiniform. The two pairs of antennae at the extreme anterior margin of the head are dorsal rather than terminal; first pair indistinctly segmented, second pair with a stout apical claw; mouth parts as in the female; two pairs of uniramose legs, each a 1-segmented lamina with two to four marginal setae.

Remarks.—This new genus was proposed in 1927 to include all those species of *Chondracanthus* that lack dorsal and ventral processes and cephalic barbs. The swimming legs are even more rudimentary than in *Chondracanthus*, and are often simple 1-segmented laminae without lobes, spines, or setae. In the males the first two thoracic segments are fused with the head, bringing all the appendages onto the cephalothorax except the minute caudal rami. The legs also are flattened laminae with marginal setae.

KEY TO THE SPECIES (FEMALES)

1. First 2 thoracic segments much wider than head; posterior processes longer that last trunk segment-------- exilipes, new species (p. 501)
   First 2 thoracic segments much narrower than head; posterior processes much shorter than last trunk segment-------------------------- 2
2. Head transversely elliptical, wider than long, not narrowed at either end; fused fourth and fifth segment definitely longer than third-- 3
   Head much longer than wide, one end conspicuously narrowed; fused fourth and fifth segment longer or shorter than third------------ 4

3. Second thoracic segment narrowed anteriorly; swimming legs with short, knoblike lobes, which are smooth______________ flurae (p. 502)
   Second thoracic segment not narrowed anteriorly; swimming legs deeply lobed and covered with spinules_________________ depressa (p. 503)
4. Head ovate, narrowed anteriorly; swimming legs with very short and blunt lobes; fourth segment shorter than third______ phycidis (p. 504)
   Head obovate, narrowed posteriorly; swimming legs with long and acuminate lobes; fourth segment longer_____________ galerita (p. 505)

ACANTHOCHONDRIA EXILIPES, new species

Plate 37, *a–e*

Occurrence.—A female with attached male was taken from the gills of the tile fish (*Lopholatilus chamaeleonticeps*) by M. T. Thompson in July, 1914, and is made the holotype of the new species with U.S.N.M. No. 59777. The fish was captured on the continental slope south of Woods Hole. From the same host and locality Rathbun secured six specimens in August, 1881, and a little farther east Vinal Edwards obtained 40 specimens in July, 1902.

Color (preserved material).—Body a uniform brownish yellow.

Female.—Head elliptical, longer than wide, narrowed anteriorly and slightly widened across the posterior margin, which is squarely truncated. Carapace covering the entire dorsal surface, split lengthwise on the midline nearly to the posterior margin. First two metasome segments free, the first slightly wider than the head and the second a little wider than the first. The legs usually extend out laterally so as to become more or less visible in dorsal view. Last three metasome segments fused, the division between the third and fourth segments indicated by a fairly distinct dorsal groove, that between the fourth and fifth segments merely indicated by lateral indentations. Fifth segment produced posteriorly into a conical process at each corner; these processes taper to a blunt point, curve inward so that their tips nearly come together, and are longer than the combined fourth and fifth segments, reaching half their length beyond the tip of the abdomen. Genital segment small, about as wide as long; abdomen made up of a single segment swollen into a sphere nearly as wide as the genital segment and bearing on its ventral surface near the base of the segment a pair of conical caudal rami, each armed with a single lateral seta.

First antenna narrow cylindrical, the jointing so indistinct that it appears 1-segmented, and tipped with a tuft of small setae. Second antenna with a short and broad basal segment and a stout apical claw, curved into a semicircle. Mandibles sickle-shaped, the teeth on the posterior margin larger than usual and slightly separated from one another. First maxilla made up of a single stout segment tipped with two setae and without a palp; second maxilla with a subquadrate basal segment and a short apical claw toothed along its convex margin. Maxilliped 3-segmented, the distal segment with a slender apical claw and a rounded lobe armed with short spines. Both pairs of legs are cylindrical and biramose, the endopods longer than the exopods, both rami unarmed. Neither ramus is jointed with the basipod and hence these legs correspond well with those of the following species, in which each leg is uniramose and bilobed at the tip. Total length, 7.5–8 mm. Greatest width, 3 mm. Length of ovisacs, 7–9 mm.

Male.—Body pyriform; head fused dorsally with the first two metasome segments, but ventrally there is a short median groove between the first and second segments, which does not reach the lateral margins. Trunk distinctly 3-segmented, the terminal segment carrying the spermatophore receptacles; caudal rami rather stout, conical, acuminate, and each bent into a sigmoid curve. Antennae similar to those of the female and both pairs distinctly dorsal in their attachment. Mouth parts like those of the female, but relatively larger and stouter; each leg a tiny 1-segmented lamina with two small setae. Total length, 0.55–0.65 mm.

Remarks.—This new species is evidently quite common upon the tile fish, to judge by the number of specimens obtained. It can be recognized in the female by the length of the posterior processes on the metasome together with the width of the first two free segments, and in the male by the curiously curved caudal rami.

ACANTHOCHONDRIA FLURAE (Krøyer)

Plate 37, *f–n*

Chondracanthus flurae Krøyer, Naturh. Tidsskrift, ser. 3, vol. 2, p. 249, pl. 13, 1863.—T. and A. Scott, The British parasitic Copepoda, p. 171, pls. 47, 53, 1913.

Occurrence.—Taken from the gills of the fluke (*Glyptocephalus cynoglossus*), captured on Georges Bank in 1878, and from the gills of the sand dab (*Hippoglossoides platessoides*) north of the present area, off Cape Ann.

Distribution.—Kattegat (Krøyer); Irish Sea, Scottish coast (T. and A. Scott); off Middleton Island, Alaska (Wilson).

Color (preserved material).—Body a uniform brownish yellow.

Female.—Head transversely elliptical, wider than long; first two thoracic segments well defined, narrower than the head, the second segment wider and longer than the first. Third segment distinctly separated from the fourth and more than twice as wide as the first segment; fused fourth and fifth segment a little longer than the third, its posterior processes short and slightly convergent; urosome 2-segmented, not reaching the tips of the posterior processes. First antennae moderately fleshy, 2-segmented, the distal segment small and globular; second antennae short, with stout apical claws; mandibles fringed with coarse, blunt teeth; teeth of maxilla also coarse and curved, palp stylet-shaped. Swimming legs small and rudimentary, with knoblike lobes; ovisacs as long as the body. Total length, 5 mm.

Male.—Head fused with first two thoracic segments; trunk 3-segmented, the anal segment the longest; caudal rami slender and setiform. First antennae showing no segmentation; second antennae very stout, with a swollen basal segment and a strong apical claw; terminal segment of maxilla clawlike, without teeth; terminal claw of maxilliped small, with an accessory spine at its base. Swimming legs very small, each a minute process tipped with two setae. Total length, 0.45 mm.

Remarks.—Krøyer and T. and A. Scott separate this species from *cornutus*, but Hansen makes the two synonymous. If Scott's figures of the mandible and maxilla of the female of *cornutus* and of the swimming legs of the male are correct, then surely the two species are distinct. The species may be identified by the characters given in the key and may be distinguished from *cornutus* by the fact that the head is wider than long and the body is short and stout.

ACANTHOCHONDRIA DEPRESSA (T. Scott)

FIGURE 299, *a*

Chondracanthus depressus T. SCOTT, 23d Ann. Rep. Fishery Board Scotland, pt. 3, p. 114, pl. 6, figs. 7–13, 1905.

Occurrence.—Taken from the gills of the common winter flounder (*Pseudopleuronectes americanus*), captured in Vineyard Sound, July, 1883.

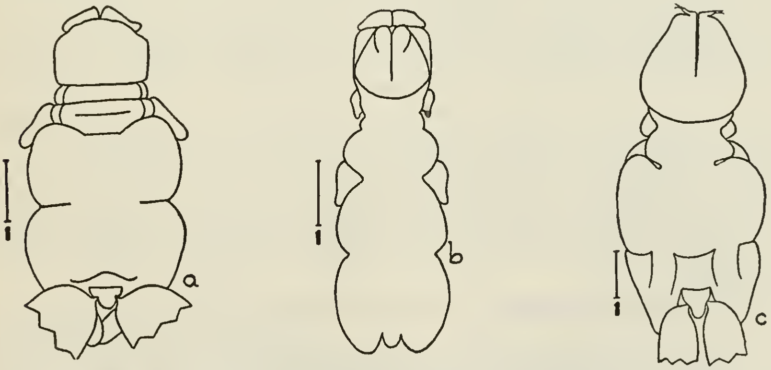

FIGURE 299.—*a, Acanthochondria depressa,* female, dorsal (after T. Scott); *b, A. galerita,* female, dorsal (after Rathbun); *c, A. phycidis,* female, dorsal (after Rathbun)

Distribution.—Irish Sea, Scottish coast (T. and A. Scott).

Color.—Preserved specimens are a uniform brownish yellow.

Female.—Head subquadrangular, about the same width and length; first and second thoracic segments very short and considerably narrower than the head; third segment separated from the fourth by a distinct groove; posterior processes short and blunt and convergent, so that their tips usually touch; urosome 2-segmented and very short. First antennae stout, 2-segmented, with scattered apical spinules; second antennae with a stout apical claw; mandibles slender and acuminate; maxilla toothed only distally, without a palp. Swimming legs biramose, rami flattened and covered with minute spinules. Total length, 5 mm.

Male.—Unknown.

Remarks.—This species has never before been reported from American shores; it may be recognized by the structure of the swimming legs.

ACANTHOCHONDRIA PHYCIDIS (Rathbun)

FIGURE 299, *c*

Chondracanthus phycidis RATHBUN, Proc. U. S. Nat. Mus., vol. 9, p. 320, pls. 9, 10, 1886.

Occurrence.—Fifteen females, most of them with attached males, were taken from the gills of the common hake (*Urophycis tenuis*), captured off Marthas Vineyard by Rathbun in 1883.

Distribution.—Not found outside the present area.

Color (preserved material).—Body a yellowish or dingy white; oviducts a light yellow or yellowish buff.

Female.—Head ovate, narrowed anteriorly, the frontal margin straight or slightly concave; in side view the dorsal surface is strongly arched and the thickness in the region of the mouth is equal to the greatest width. First and second segments narrower than the head and imperfectly separated; third segment abruptly widened to twice the width of the first segment, separated from the fourth segment by a partial groove and lateral indentations. Genital segment small; abdomen a single subglobular segment; no caudal rami. First antenna cylindrical, 2-segmented; second antenna with a swollen basal segment and a stout apical claw; each leg 1-segmented, nearly cylindrical, and slightly bilobed at its distal end. Total length, 5–5.5 mm.

Male.—Body pyriform; head fused with first two thorax segments (the second segment partly separated dorsally) and much larger than the rest of the body; trunk indistinctly 4-segmented; caudal rami slender, conical, acuminate. First antennae apparently made up of a single segment; second antennae with a swollen basal segment and a stout apical claw; mandible falcate, acuminate, fringed with fine saw teeth; maxilla with a palp, the outer margin of the distal segment serrate; maxillipeds long and slender, 2-segmented, with a stout apical claw. Total length, 0.5–0.55 mm.

Remarks.—The one lot secured by Rathbun are the only specimens of this species thus far obtained. The size and shape of the head and trunk and the stoutness of the posterior processes are the distinguishing characters.

ACANTHOCHONDRIA GALERITA (Rathbun)

FIGURE 299, *b*

Chrondracanthus galeritus RATHBUN, Proc. U. S. Nat. Mus., vol. 9, p. 317, pl. 8, figs. 1–7, pl. 10, figs. 1–7, 1886.

Occurrence.—Many females with attached males were taken from the mouth of the common flounder (*Paralichthys dentatus*), at Woods Hole in August, 1883, by Rathbun, and in August, 1900, and July, 1904, by Vinal Edwards.

Distribution.—Not found outside the present area.

Color.—Body whitish, the head and anterior thorax translucent, the remainder of the body opaque; oviducts and ovisacs yellowish, the latter becoming pink as they mature.

Female.—Head a little longer than wide, widest anteriorly and narrowed posteriorly, the carapace strongly arched and gibbous behind; first segment much narrower than the head, second segment the same width as the head, third segment considerably wider and separated from the fourth segment; posterior processes short, stout, and bluntly rounded. Genital segment as wide as long; the single abdominal segment less than half the size of the genital segment, with a pair of small setose caudal rami on the ventral surface near the base. First antennae fleshy, triangular, and unsegmented; second antennae stout; mandible long and acuminate, fringed with coarse and rather blunt teeth; maxilla without a palp; each swimming leg bifid at its tip, the branches acuminate. Total length, 6–7 mm.

Male.—Body pyriform; head fused with the first two segments and much larger than the rest of the body; trunk 4-segmented; caudal rami stout, conical, and acuminate. First antenna cylindrical, 2-segmented; second antenna rather larger and stouter than in the other species; maxillipeds also longer and stouter. Each swimming leg is made up of a single dactylose segment tipped with two small setae. Total length, 0.45–0.52 mm.

Remarks.—This copepod is usually found in the mouth of the flounder, just inside the lips, with its head buried in the skin. It can be identified by the obovate head, widest anteriorly, and the short and blunt posterior processes turned downward beneath the egg strings.

CHONDRACANTHODES, new genus

Female.—Head separated from first segment, considerably elongated, and strongly deflexed; thorax more or less distinctly 4-segmented; first segment bearing first legs only, second and third segments with a stout blunt process on each lateral margin, fourth segment with a similar process at each posterior corner, all the processes directed ventrally. Second segment with a process on the dorsal midline, projecting forward over the first segment; flattened knobs on the dorsal surface of the third and fourth segments. Urosome made up of a genital and two abdominal segments, partially fused; caudal rami minute unarmed. First antennae fleshy and 1-segmented; second antennae with stout apical claws; mandibles not fringed with teeth; maxilla without a palp; maxilliped 2-segmented, with an apical claw. Two pairs of biramose legs, rami cylindrical, 1-segmented. Ovisacs cylindrical, eggs multiseriate.

Male.—Head fused with the first segment and much larger than the rest of the body; carapace projecting laterally in a rounded knob on each side opposite the mouth; trunk 4-segmented, anal segment the longest; caudal rami stout, conical, and armed with a minute terminal seta. First antenna a single segment; second antenna projecting forward, with a stout apical claw, and an accessory claw on the outer margin of the distal segment; maxillae and maxillipeds well developed and uncinate. Two pairs of biramose legs, the rami flattened laminae, the exopod armed with small spines, the endopod unarmed.

Genotype.—*Chrondracanthodes deflexus*, new species.

Remarks.—This new genus may be recognized by the ventral flexure of the head, which in the adult is turned at right angles to the body axis. Probably Thomson's *Chondracanthus lotellae* belongs here, and the United States National Museum has another new species of this genus that will be described later.

CHONDRACANTHODES DEFLEXUS, new species

Plate 38

Occurrence.—A female with an attached male, taken from the gills of the common grenadier (*Macrourus bairdii*), captured by Rathbun southeast of Marthas Vineyard, July, 1883, is made the type of the new species with United States National Museum No. 59779. Two other specimens were obtained from the same host and locality in 1883. Another specimen was taken from the same host in 1883 at Station 2097, *Albatross*, and still another in 1884 at Station 2173, *Albatross*.

Color (preserved material).—Body a uniform brownish yellow.

Female.—Body short and stout; head deflexed at right angles to the body axis, somewhat flattened dorso-ventrally, and enlarged where it joins the thorax. First segment very short and bearing only the first legs on its ventral surface; to each side of the second, third, and fourth segments is attached a short, clavate, fleshy process, the first two pairs extending ventrally, the third pair outward and backward. The genital segment is about the same length and width, the single abdominal segment is globular and without caudal rami. On the dorsal surface of the second segment is a flattened ridge along the midline, which grows forward against the first segment and pushes the latter first into an oblique position, and eventually into a vertical position. In the youngest specimens obtained the head is but little deflexed, but in all the maturer specimens it is turned downward at a right angle. There are similar pads along the dorsal midline of the third and fourth segments, and they also push forward against the segment in front of them. The dorsal portion of the grooves between the segments is thus carried considerably in front of the ventral portion.

The first antennae are small, fleshy, and unsegmented; the second antenna is large and stout; its terminal claw is curved but little, is very bluntly rounded, and is armed on its concave margin with a short process. The mandible is almost straight, rather bluntly pointed, and has no fringe of teeth along either margin. The terminal segment of the maxilla is spinelike and has three or four teeth on its inner margin; the palp is lacking. The maxilliped is 2-segmented, the distal segment ending in a rounded denticulate knob and a short and stout claw. Each swimming leg consists of a swollen and more or less cylindrical basipod tipped with two minute, 1-segmented rami. Ovisacs cylindrical and longer than the urosome. Total length, 3.5–4 mm. Greatest width, 2.25 mm.

Male.—Head fused with the first segment and ventrally with the second segment, but the latter is separated on the dorsal surface by a well-defined groove. The carapace also covers the first segment but does not cover the second, and forms a knoblike angle on each side opposite the mouth. The trunk is distinctly segmented and about the same diameter throughout; the caudal rami are stout and conical, more or less fused at the base, and each is tipped with a minute cilium. The first antennae are slender and indistinctly 3-segmented, armed with small spines; the second antenna is 3-segmented, with a curved apical claw and a stout accessory claw on the outer margin of the distal segment. The mouth parts are similar to those of the female; the swimming legs are biramose, each made up of a laminate basipod, armed with a stout seta at its outer distal corner, and two flattened rami. The exopods are ovate and armed apically with three or four spines, the endopods are spatulate and unarmed, the two rami are about the same length. Total length, 0.45–0.5 mm.

Remarks.—The hosts of this parasite are deep-sea fishes that frequent the continental slope at the southern end of the present area, and in every instance only a single female with attached male was obtained from each host. The female can be recognized by the deflection of the head and the three pairs of clavate processes, the male by the second antennae and the swimming legs.

CHONDRACANTHOPSIS, new genus

Female.—Head separated from the first segment and much wider than long; first two thoracic segments distinctly separated, the rest of the thorax completely fused and armed with a row of rounded knobs along each lateral margin, and a row of transverse laminae down the midline of the dorsal surface. These laminae are semilunar and are folded back against the dorsal surface of the thorax; urosome small, 2-segmented. First antennae 1-segmented; second antennae with stout apical claws; mandibles falcate, toothed on both edges; maxillae spiniform, toothed on the outer margin; maxillipeds 2-segmented, uncinate. Two pairs of uniramose legs, each made up of a winged basal segment and a boot-shaped distal segment. Ovisacs cylindrical, longer than the body.

Male.—Head fused with the first two thoracic segments, both pairs of antennae at the extreme anterior end, which is somewhat pointed; trunk 3-segmented; caudal rami slender, conical, each ending in a small cilium. Mouth parts like those of the female; two pairs of uniramose legs, each made up of a swollen lamina, with two minute apical setae.

Genotype.—Chrondracanthopsis nodosus (Müller).

Remarks.—This new genus is established for the species *Chondracanthus nodosus* of Krøyer, and to it possibly belongs also Scott's species *ornatus*, but we know nothing about the swimming legs of this latter species, and they are the chief characteristic of the present genus. The species has never before been reported from this side of the Atlantic, although it is common around the British Isles.

CHONDRACANTHOPSIS NODOSUS (Müller)

PLATE 39

Lernaea nodosa O. F. MÜLLER, Zoologia Danica, p. 40, pl. 33, fig. 5, 1779.
Chondracanthus nodosus T. and A. SCOTT, The British parasitic Copepoda, p. 176, pl. 48, figs. 13–16; pl. 52, figs. 1–3, 1913.

Occurrence.—Taken from the gills of the common redfish (*Sebastes marinus*), captured at three different localities north and east of Cape Cod in 1878.

Distribution.—British seas (T. and A. Scott); North Sea (T. Scott); Faroe Islands (Krøyer); Norwegian coast, Skager Rak (Olsson); Greenland (Hansen).

Color (preserved material).—Body a uniform dark reddish brown.

Female.—Head and trunk strongly depressed; first two thoracic segments little more than half the width of the head; rest of thorax completely fused with a row of six or seven lobes along each lateral margin and around the posterior end. Urosome 2-segmented, the segment representing the abdomen globular and without any caudal rami. First antennae narrowed into a globular tip but not segmented; the apical claws of the second antennae curved into a half circle; mandibles falcate and rather coarsely toothed; basal segment of each swimming leg with a broad gibbous wing on either side, distal segment boot-shaped, the leg of the boot attached to the basal segment, the toe pointed outward. Ovisacs cylindrical and a little longer than the body. Total length, 7–7.5 mm.

Male.—Head fused with first two thoracic segments, wholly covered with the carapace, which does not form a rounded projection on each lateral margin, as in the previous genus. Trunk with three distinct segments, the anal segment nearly as long as the other two; caudal rami conical, acuminate, and completely separate. First antenna 1-segmented, quite short, and tipped with four setae; apical claw of second antenna long and stout; mouth parts like those of the female; swimming legs uniramose, 1-segmented. Total length, 0.4–0.5 mm.

Remarks.—This copepod can be identified at once by the peculiar form of the swimming legs. Thus far it has only been found on a single host.

Family. LERNAEOPODIDAE

Genus THYSANOTE Krøyer, 1863

Female.—Head fused with the thorax or only imperfectly separated, short, somewhat depressed and curved over ventrally. The rest of the body fused into a trunk, also depressed and enlarged posteriorly, with two bundles of ramose processes at each posterior corner, one dorsal and one ventral, and between the ventral bundles a pair of unbranched processes on the midline; no genital process, abdomen, or caudal rami. Branched or unbranched fimbriate processes attached to the posterior margin of the second maxillae and to the body at the base of the second maxillae. First antennae small and indistinctly segmented; second antennae biramose; first maxilla large, tripartite; second maxillae united only at their tips, bulla mushroom-shaped; maxillipeds large and strong.

Male.—Cephalothorax in line with the trunk and fused with it or separated by a groove; no dorsal carapace; trunk unsegmented, tapered posteriorly and tipped with two conical caudal rami, which are curved ventrally; no abdomen. Second antennae uncinate; second maxillae and maxillipeds with stout sickle-shaped claws, sometimes forming a chela, sometimes twisted like a corkscrew. A single species within the present area.

THYSANOTE POMACANTHI Krøyer

FIGURE 300, *a*

Thysanote pomacanthi KRØYER, Naturh. Tidsskrift, ser. 3, vol. 2, p. 288, pl. 15, 1863.

Occurrence.—Two females were taken from the gills of the black angel fish (*Pomacanthus arcuatus*), captured near Woods Hole by V. N. Edwards.

Distribution.—West Indies (Krøyer).

Color.—Body a clear milky white, becoming golden-brown in preservatives.

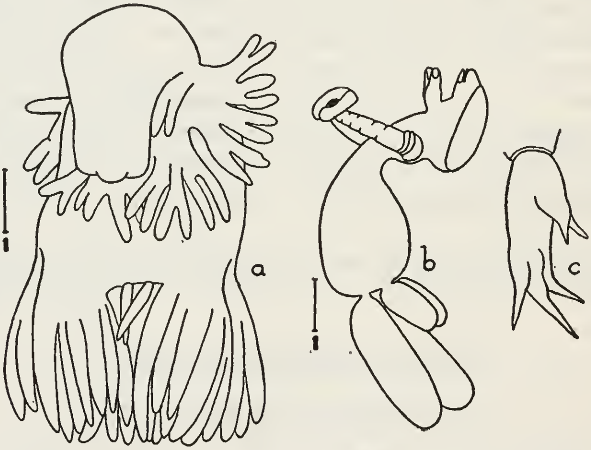

FIGURE 300.—*a, Thysanote pomacanthi,* female, ventral (drawn by M. T. Thompson); *b, Charopinus bicaudatus,* female, lateral; *c, C. bicaudatus,* female, second maxilla

Female.—Body somewhat narrowed anteriorly and widened posteriorly; head tolerably distinctly separated from the thorax, about twice as wide as long. Remainder of body fused into a trunk three-fourths of the entire length; posterior ramose processes recurved at their tips, close together and forming a sort of skirt, entirely concealing the ovisacs. On the posterior margin of each second maxilla are two bundles of filose processes, each containing four biramose threads. First antenna indistinctly 3-segmented; second antenna biramose at its tip, short and stout; attachment bulla small and dark brown in color. Total length, 6–7 mm.

Male.—Unknown.

Remarks.—The host named above is a native of the West Indies and seldom wanders as far north as the Massachusetts coast, where this one was captured. The figure here given is one made by M. T. Thompson, to whom Mr. Edwards turned over the specimens for study. With several other sketches made by Thompson and the notes which he left, the identity of the species is established beyond any reasonable doubt.

Genus CHAROPINUS Krøyer, 1863

Female.—Head more or less distinctly separated from the trunk, with or without a carapace, usually flexed backward at right angles to the trunk or even against its dorsal surface. Trunk enlarged and often flattened, usually with a pair of posterior processes dorsal to the ovisacs; no genital process, abdomen, or caudal rami. Two pairs of antennae and four pairs of mouth parts; second maxillae sometimes joined at their tips with a bulla or a chitin rod, sometimes separate, their tips enlarged into various shapes.

Male.—Anterior portion of head at right angles to posterior portion and the thorax; no carapace; thorax segmented with an enlarged genital segment; abdomen well defined, segmented, and tipped with caudal rami. First antennae 3-segmented; second antennae biramose and usually chelate; first maxillae tripartite, the palp with two setae; second maxillae and maxillipeds some distance behind the other mouth parts, close together and separated by a groove. A single species here.

CHAROPINUS BICAUDATUS (Krøyer)

FIGURES 300, *b*, *c*; 301

Lernaeopoda bicaudata KRØYER, Naturh. Tidsskrift, vol. 1, p. 275, pl. 3, fig. 11, 1837.

Charopinus bicaudatus WILSON, Proc. U. S. Nat. Mus., vol. 47, p. 656; pls. 41, 42. 1915.

Occurrence.—Females with attached males were taken from the nostrils of the spiny dogfish (*Squalus acanthias*) at Woods Hole by Dr. H. M. Smith in August, 1922, and by the present author in July, 1923.

Distribution.—Danish coast (Krøyer); Belgian coast (Beneden); Mediterranean (Kurz, Valle, Carus); British seas (Bainbridge, T. and A. Scott, Norman and Brady); Casco Bay, Me. (Wilson).

Color.—Body a uniform grayish white.

Female.—Head short and wide and inclined dorsally at an angle of 45° to the trunk axis; a narrow dorsal carapace divided lengthwise on the midline. Trunk pear shaped, narrowed into a long neck anteriorly, swollen and depressed posteriorly; posterior processes cylindrical, plump, and half as long as the ovisacs. First antennae 2-segmented; second antennae biramose, both rami 1-segmented, the endopod larger than the exopod; second maxillae entirely separate, two-fifths as long as the trunk, each enlarged at its tip into a crescent or semicircle; maxillipeds with slender terminal claws. Total length, 5.5–6 mm.

Male.—Head conical, considerably swollen and gibbous posteriorly, the mouth at the extreme anterior end and terminal, the part bearing the second maxillae and maxillipeds near the posterior end and separated from the rest of the head by a groove. Trunk distinctly 4-segmented, the first two segments thoracic; the third, the genital segment, somewhat enlarged, the fourth segment representing the abdomen and bearing the caudal rami, each of which is conical with a single apical seta. First antennae on the dorsal surface of the head near the anterior end; each is 4-segmented and carries a single terminal seta. Second antenna biramose, the exopod 2-segmented, the basal segment twice the length of the distal, with a stout pointed process on its inner margin. The end segment carries at its inner distal corner a rigid curved claw, and at the outer corner a rounded knob armed with stiff spines; between the two on the distal margin is a small process tipped with a single seta. The endopod is clavate and 1-segmented, the distal end with a fringe of short hairs, the inner distal corner with a small process ending in a seta. The first maxilla is 2-segmented, with three apical setae, the palp is replaced by a single seta. The basal segments of the second maxillae are fused across the midline, the terminal segments are free and each has a slender apical claw. The maxillipeds are swollen into spheres, with small apical claws shutting against a spiny plate on the side of the sphere. Total length, 0.9–1.1 mm.

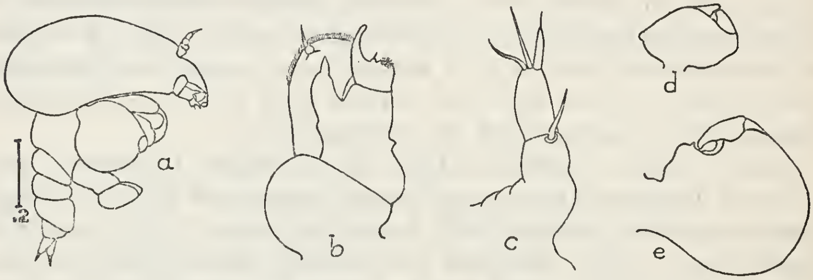

FIGURE 301.—*Charopinus bicaudatus: a,* Male, lateral; *b,* male, second antenna; *c,* male, first maxilla; *d,* male, second maxilla: *e,* male, maxilliped

Remarks.—The male is here described for the first time and corresponds very closely with the males of other species of the genus, thus confirming the transfer of this species from the genus *Lernaeopoda* to *Charopinus*. This is the only copepod parasite thus far found at the outer edge of a shark's spiracle in plain view from the outside.

Genus CLAVELLA Oken, 1815

Female.—Head distinctly separated from the trunk, elongated and cylindrical, and standing at an angle with the axis of the trunk, usually without a carapace. Trunk pear-shaped or ovoid, without posterior processes, abdomen, or caudal rami, and with no traces of segmentation, but an unpaired genital process is often present. Two pairs of antennae and four pairs of mouth parts; second maxillae entirely fused, sometimes so short as to be virtually lacking, bulla spherical or knoblike; swimming legs obsolete.

Male.—Head and trunk folded together ventrally and fused into an unsegmented ovoid, in which there is no distinction of body regions; no carapace or caudal rami. Two pairs of antennae and four pairs of mouth parts; second maxillae and maxillipeds uncinate and close to the mouth tube; all the appendages pointed diagonally downward and forward.

KEY TO THE SPECIES (FEMALES)

1. Genital process present, one-fourth as long as trunk; the latter as wide as long or wider ---------- uncinata (p. 513)
   Genital process lacking; trunk much longer than wide, ellipsoidal and only slightly depressed ---------- 2
2. Trunk twice as long as wide, with transverse grooves on ventral surface on either side of midline ---------- insolita (p. 514)
   Trunk three times as long as wide, ventral surface smooth, without transverse grooves ---------- pinguis (p. 515)

CLAVELLA UNCINATA (Müller)

FIGURE 302

Lernaea uncinata Müller, Zoologiae Danicae prodromus, p. 38, pl. 33, fig. 2, 1776.
Clavella uncinata Wilson, Proc. U. S. Nat. Mus., vol. 47, p. 680, pls. 27, 48, 49, 1915.

Occurrence.—Found in abundance on the gills of the common cod caught in the vicinity of Woods Hole, also on the gills of the pollack, haddock, and hake.

Distribution.—Danish coast (Müller, Krøyer); northern Atlantic and Pacific (Desmarest, Blainville, Nordmann); Belgian coast (Beneden); English seas (T. and A. Scott, Baird, Thompson); Roscoff (Vogt); Mediterranean (Brian); Iceland and Greenland (Hansen); Vancouver Island (Fraser); Casco Bay, Me. (Wilson); Woods Hole (Rathbun, Wilson).

Color.—Body a uniform orange-yellow, lighter in living specimens and turning darker in preservatives.

Female.—Head cylindrical, longer than the trunk, squarely truncated anteriorly; no carapace. Trunk depressed, somewhat quadrilateral, with rounded corners and a reentrant posterior margin; genital process on a level with the ventral surface. First antennae 3-segmented; second antennae turned across the frontal margin; second maxillae completely fused and reduced so much as to often appear obsolete; maxillipeds overlapping the other mouth parts. Length of head, 5–7 mm.; of trunk, 4–6 mm.; of ovisacs, 6–10 mm.

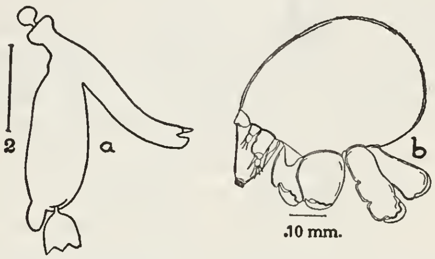

FIGURE 302.—*Clavella uncinata: a,* Female, lateral; *b,* male, lateral

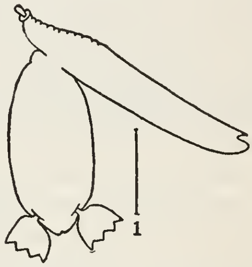

FIGURE 303.—*Clavella insolita:* Female, lateral

Male.—Body ovoid, one-third longer than wide. First antennae 2-segmented; second antennae biramose, exopod 3-segmented, setose, endopod 1-segmented, unarmed; mouth tube projecting diagonally downward and forward; first maxilla bipartite, the palp with a single seta; second maxilla long and slender, with a short claw; maxillipeds short and stout, with a strong apical claw; between the maxillipeds on the midline is a short rounded process. Total length, 0.45–0.5 mm.

Remarks.—This species may be distinguished from the other two of *Clavella* here described by the presence of a genital process at the posterior end of the trunk. It appears to have a decided preference for gadoid fish.

CLAVELLA INSOLITA Wilson

FIGURE 303

Clavella insolita WILSON, Proc. U. S. Nat. Mus., vol. 47, p. 676, pl. 46, 1915.

Occurrence.—Taken from the pectoral fins of the snake blenny (*Lumpenus lampetraeformis*), captured at Woods Hole.

Distribution.—Not found outside the present area.

Color (preserved material).—Body dark cinnamon-brown, ovisacs red.

Female.—Head slender, cylindrical, squarely truncated anteriorly, without a carapace. Trunk ellipsoidal, one-third shorter than the head, with a row of shallow transverse grooves along either side of the midline on the ventral surface; genital process not showing externally, but outlined inside the skin. First antennae 3-segmented; second antennae uniramose; first maxilla bipartite at its tip, with a minute palp bearing a single seta; second maxillae fused for their entire length; maxillipeds removed from the mouth tube far enough not to overlap the other mouth parts. Length of head, 3 mm.; of trunk, 2.1 mm.

Male.—Unknown.

Remarks.—The host of this parasite is rare within the present area, and this will account for the limited number of specimens found.

CLAVELLA PINGUIS Wilson

FIGURE 304

Clavella pinguis WILSON, Proc. U. S. Nat. Mus., vol. 47, p. 678, pl. 47, 1915.

Occurrence.—Taken from the pectoral fins of an eelpout (*Lycodes frigidus*), captured in deep water southeast of Nantucket Island.

Distribution.—New Jersey coast, Nova Scotia coast (Wilson).

Color (preserved material).—Body a deep brownish yellow; eggs orange.

Female.—Head slender, cylindrical, a little longer than the trunk, without a dorsal carapace. Trunk elongate, elliptical, three times as long as wide, without a genital process. First antennae indistinctly 2-segmented; second antennae uniramose, turned across the frontal margin; first maxilla tripartite, palp short with a single seta; second maxillae short, completely fused and tapered; apical claw of maxillipeds with a spine on the inner margin near the tip. Length of head, 4 mm.; of trunk, 3.5 mm.; of ovisacs, 3.5 mm.

Male. — Body egg-shaped, widest posteriorly; mouth tube long and directed forward in line with body axis. First antennae widely separated, 2-segmented; second antennae biramose, rami 1-segmented; first maxilla bipartite, without a palp; second maxillae and maxillipeds short and stout, with strong terminal claws. Length, 0.4 mm.

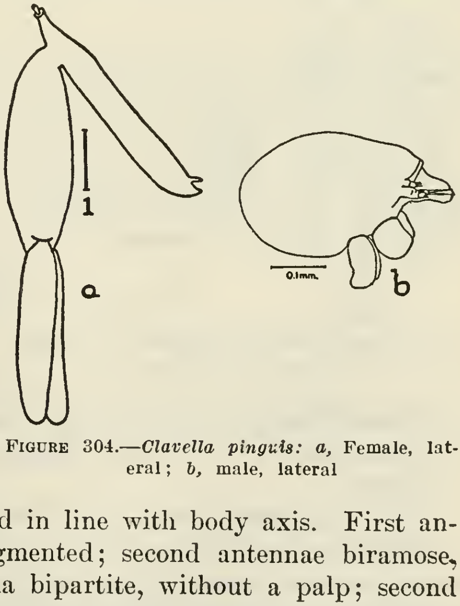

FIGURE 304.—*Clavella pinguis*: *a*, Female, lateral; *b*, male, lateral

Remarks.—This parasite is apparently confined to deep-water fishes off our Atlantic coasts and is not likely to be found anywhere near shore.

Genus CLAVELLODES Wilson, 1915

Female.—Cephalothorax longer than trunk and reflexed against the dorsal surface of the latter; head separated from the neck by a well-defined groove, with or without a dorsal carapace. Trunk depressed; no posterior processes, abdomen, or caudal rami; genital process present or absent. First antennae slender, indistinctly segmented; second antennae biramose, rami short and blunt; first maxilla tripartite, the palp with a single seta; second maxillae short and either fused or separate; terminal claw of maxillipeds with accessory claw and row of short teeth on inner margin near the tip.

Male.—Head folded ventrally upon the trunk and the two fused without any distinction of parts; general form ellipsoidal, the anterior end squarely truncated and carrying the mouth tube, the appendages, and the genital process, all of which point forward in line with the long axis of the ellipse. First antennae indistinctly segmented; second antennae biramose, endopod simple, exopod 2-segmented; first maxillae like those of the female; second maxillae larger and stronger than the maxillipeds. A single species in the present area.

CLAVELLODES RUGOSA (Krøyer)

FIGURE 305

Anchorella rugosa Krøyer, Naturh. Tidsskrift, vol. 1, p. 284, pls. 2, 3, 1837.

Clavellodes rugosa Wilson, Proc. U. S. Nat. Mus., vol. 47, p. 690, pl. 51, 1915.

Occurrence.—Taken from the gills of the wolf fish (*Anarhichas lupus*), caught on Georges Bank, July, 1922.

Distribution.—English coast (Baird, White, T. Scott); Danish coast (Krøyer); Belgian coast (Beneden); Skager Rak (Olsson); Scottish coast (T. Scott); Gloucester, Mass., Casco Bay, Me. (Wilson).

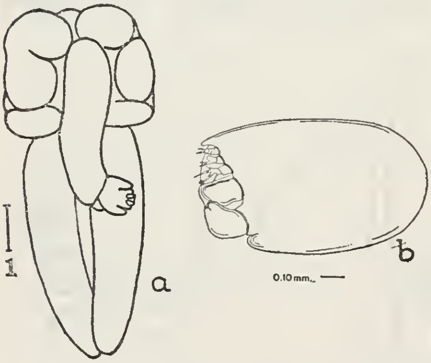

FIGURE 305.—*Clavellodes rugosa: a,* Female, dorsal; *b,* male, lateral

Color (preserved material).—Body grayish yellow; eggs orange.

Female.—Cephalothorax flexed against the dorsal surface of the trunk; head depressed and enlarged on either side into a lateral lobe. Trunk also depressed, with its entire surface thrown up into ridges separated by deep grooves; anterior and posterior margins reentrant.

First antennae 3-segmented; second antennae with 1-segmented endopod and 2-segmented exopod; first maxilla tripartite, the outer ramus the shortest; second maxillae so reduced as to bring the bulla apparently onto the surface of the trunk; basal segment of maxillipeds armed on its inner margin with knobs and processes. Length of cephalothorax, 4.5–5 mm.; of trunk, 3–3.25 mm.; of ovisacs, 5–6 mm.

Male.—Body laterally compressed and anteriorly truncated, with all the appendages and the genital process crowded along the frontal margin. First antennae 4-segmented, basal segment the largest; exopod of second antenna tipped with a tuft of short setae, endopod unarmed; second maxillae large and stout, with a long terminal claw. Total length, 1.15 mm.

Genus CLAVELLISA Wilson, 1915

Female.—Cephalothorax much longer than trunk, often wrinkled and attached to the center of the dorsal surface of the latter; head separated from the neck, with a carapace. Trunk wider than long, depressed; no genital or posterior processes, abdomen, or caudal rami. First antennae stout and heavily armed; second antennae biramose; first maxillae bipartite or tripartite, with a palp; second maxillae flat and laminate, fused or separate, and apparently attached to the anterior end of the trunk, some distance in front of the base of the neck.

Male.—Head folded ventrally onto the trunk and the two completely fused, with no distinction of parts, but with a dorsal carapace; body ovoid, pointed anteriorly, the antennae, mouth tube, and mouth parts on the ventral surface; genital process curved ventrally and projecting just behind the mouth parts. First antennae 3-segmented; second antennae biramose, rami 1-segmented; first maxillae tripartite, with a palp; second maxillae and maxillipeds with strong apical claws.

KEY TO THE SPECIES (FEMALES)

1. Ovisacs at an angle of 45° with trunk axis and attached by one side, not by end -- spinosa (p. 517)
   Ovisacs parallel with trunk axis and attached in ordinary manner by their ends -- cordata (p. 518)

CLAVELLISA SPINOSA Wilson

FIGURE 306

Clavellisa spinosa Wilson, Proc. U. S. Nat. Mus., vol. 47, p. 694, pls. 50, 52, 1915.

Occurrence.—Taken from the gills of the common menhaden (*Brevoortia tyrannus*) at Woods Hole by M. T. Thompson.

Distribution.—Beaufort, N. C. (Wilson).

Color.—Cephalothorax reddish or blackish from contents of digestive tube; trunk transparent cartilage color; oviduct and eggs white and opaque, the latter becoming orange with development.

Female.—Cephalothorax three to five times as long as the trunk; head not enlarged, covered with a carapace; neck covered with fine transverse wrinkles for two-thirds of its length behind the head. Trunk kidney-shaped, twice as wide as long, flattened on its dorsal surface; ovisacs also kidney-shaped, attached by the center of one side at an angle of 45° to the trunk axis. First antennae 3-segmented, armed with stout ensiform spines; second antennae biramose, the exopod smaller than the endopod; first maxillae tripartite; second maxillae apparently attached to the trunk in the sinus of the kidney on the anterior margin. Length of cephalothorax, 1.5 mm.; of trunk, 0.5 mm.

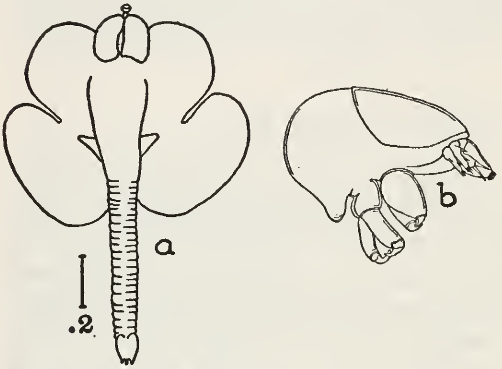

FIGURE 306.—*Clavellisa spinosa: a,* Female—head, ventral; trunk, dorsal; *b,* male, lateral

Male.—Body ovoid; pointed anteriorly, the appendages attached to the ventral surface; head with dorsal carapace; genital process behind the mouth parts; first antennae 3-segmented and pointed forward; mouth parts like those of the female, except that the terminal claw of the maxillipeds has a row of minute teeth along its inner margin. Total length, 0.25–0.3 mm.

Remarks.—This species can be identified by the shape and mode of attachment of the ovisacs and by the profusely wrinkled neck.

CLAVELLISA CORDATA Wilson

FIGURE 307

Clavellisa cordata WILSON, Proc. U. S. Nat. Mus., vol. 47, p. 697, pls. 26, 50, 52, 1915.

Occurrence.—Both sexes were taken from the gills of the hickory shad (*Pomolobus mediocris*) and from the gills of the alewife (*Pomolobus pseudoharengus*), captured at Woods Hole by V. N. Edwards in October, 1903.

Distribution.—Not found outside the present area.

Color.—Body a uniform yellowish white; oviducts and eggs inclined to pink.

Female.—Cephalothorax but little longer than trunk, the same diameter throughout and perfectly smooth; head with dorsal carapace. Trunk obcordate, as long as wide, narrowed anteriorly, with a median posterior sinus; ovisacs cylindrical, as long as trunk, attached by one end as usual. First antennae 3-segmented; exopod of second antennae 1-segmented, endopod 2-segmented; first maxillae bipartite; second maxillae attached to anterior end of trunk, some distance in front of the base of the neck. Length of cephalothorax, 4 mm.; of trunk, 3 mm.

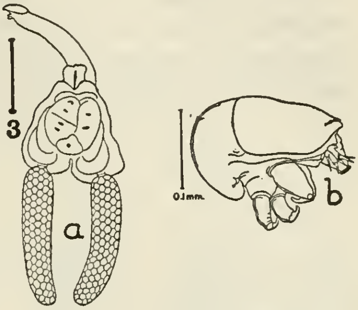

Figure 307.—*Clavellisa cordata: a,* Female, ventral; *b,* male, lateral

Male.—Body ovoid, relatively shorter than in the preceding species; head with dorsal carapace. First antennae 3-segmented, armed with ordinary setae; second antennae biramose, exopod 2-segmented and tipped with setae, endopod 1-segmented and unarmed; first maxillae bipartite; second maxillae and maxillipeds slender, with short terminal claws. Total length, 0.25–0.3 mm.

Remarks.—This parasite is fairly common on the two kinds of fishes mentioned, and can be distinguished from the preceding species by its heart-shaped trunk and smooth neck.

Genus PARABRACHIELLA Wilson, 1915

Female.—Neck separated from the trunk by a distinct groove, cylindrical; head not enlarged, with a carapace. Trunk cylindrical or slightly depressed, with one or two pairs of posterior processes and a minute genital process; no abdomen or caudal rami. First antennae 4-segmented; second antennae biramose; first maxillae bipartite or tripartite, the palp with two setae; second maxillae united only at their tips; maxillipeds of the usual form close to the mouth.

Male.—Head at right angles to axis of trunk, but the whole body so completely fused as to show no distinction of parts; no carapace; trunk strongly swollen dorsally, but with a flat ventral surface; a pair of small caudal rami. First antennae 3-segmented; second antennae biramose, the rami rudimentary; first maxillae tripartite; second maxillae and maxillipeds very small, close together, and removed from the mouth tube. A single species in this area.

PARABRACHIELLA ROSTRATA (Krøyer)

Figure 308

Brachiella rostrata Krøyer, Naturh. Tidsskrift, vol. 1, p. 207, pl. 2, 1837.

Parabrachiella rostrata Wilson, Proc. U. S. Nat. Mus., vol. 47, p. 714, pl. 28, 56, 1915.

Occurrence.—Both sexes were taken from the gills of a halibut captured on Georges Bank by a Gloucester fishing vessel in 1883.

Distribution.—Kattegat, Greenland (Krøyer); Belgian coast (Beneden); English seas (T. and A. Scott); Skager Rak (Olsson); Massachusetts coast (Rathbun).

Color.—Body of preserved specimens a uniform brownish yellow.

Female.—Head and neck as long as the trunk and of the same diameter throughout; carapace squarely truncated anteriorly. Trunk three times as long as wide; a single pair of posterior processes, small, conical, and ventral to the ovisacs. First antennae with enlarged bases and an apical tuft of setae; second antennae turned across the frontal margin, the endopod 1-segmented, with small spines at the tip, the exopod 2-segmented and tipped with three spines; second maxillae cylindrical and tapered distally; apical claw of maxillipeds with two spines on its inner margin. Length of cephalothorax, 5–6 mm.; of trunk, 6–6.5 mm.

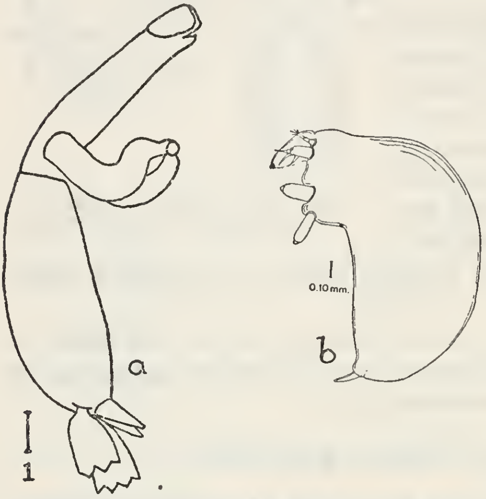

FIGURE 308.—*Parabrachiella rostrata: a,* Female, lateral; *b,* male, lateral

Male.—Anterior end of head squarely truncated, turned at right angles to the trunk axis and projecting ventrally beyond the level of the trunk, the antennae and mouth parts arranged along the truncated end. The trunk twice as long as wide, the caudal rami short, conical, and pointed. Both rami of second antennae reduced to mere knobs; palp of first maxilla with a single seta; second maxillae no longer than the maxillipeds. Total length, 2 mm.

Remarks.—This parasite in the present area is found only on the gills of the halibut and can be recognized by its exceptionally large size.

Genus BRACHIELLA Cuvier, 1830

Female.—Cephalothorax elongate and cylindrical, usually flexed; head enlarged and covered by a carapace. Trunk swollen, depressed, and in the larger species with two rows of pits or grooves on the dorsal and ventral surfaces; one or two pairs of posterior processes and an unpaired genital process; no abdomen or caudal rami. First antennae 2- to 4-segmented; second antennae biramose, the exopod 2-segmented; second maxillae usually separate to their tips, where they are joined to an ordinary bulla.

Male.—Cephalothorax inclined to the trunk, from which it is separated by a constriction, often by a short neck; head with a carapace.

Trunk straight, spindle-shaped, narrower than the cephalothorax; caudal rami small. First antennae 3-segmented; second antennae biramose, the exopod 2-segmented; second maxillae and maxillipeds close together and about the same size, often with a large process between the bases of the second maxillae.

KEY TO THE SPECIES (FEMALES)

1. A single pair of posterior processes, either dorsal or ventral ____ 2
   Two pairs of posterior processes, one dorsal, one ventral ____ 3
2. Posterior processes cylindrical, widely separated and dorsal to the ovisacs; no genital process ____ concava (p. 521)
   Posterior processes laminate, close together and ventral to ovisacs; genital process present ____ mitrata (p. 522)
3. Ventral processes two and a half times as long as dorsal; trunk twice as long as cephalothorax ____ elegans (p. 522)
   Ventral processes little longer than dorsal; trunk only half as long as cephalothorax ____ gulosa (p. 523)

BRACHIELLA CONCAVA Wilson

FIGURE 309

Brachiella concava WILSON, Proc. U. S. Nat. Mus., vol. 44, p. 262, pl. 51, 1913.

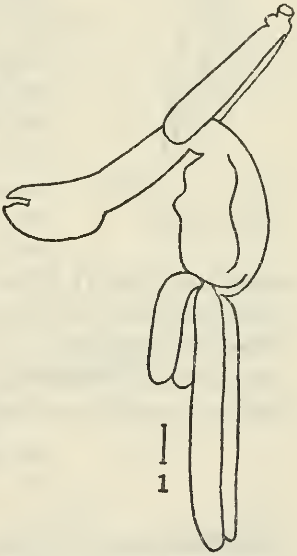

FIGURE 309.—*Brachiella concava:* Female, lateral

Occurrence.—A single female taken from the gill arches of the sting ray (*Dasybatus marinus*) captured at Menemsha Bight, Marthas Vineyard, August, 1925.

Distribution.—Jamaica, West Indies (Wilson).

Color.—Head and neck a clear cartilage gray; trunk yellowish; oviducts white; eggs straw yellow, deepening in color with development.

Female.—Cephalothorax flexed backward and longer than the trunk; head much enlarged; trunk short, oval, strongly depressed, its dorsal surface crenate; posterior processes attached close together on the midline, but turned outward at first and then backward, thus becoming widely separated, each four times as long as wide; ovisacs the same diameter as the processes but twice as long. First antenna indistinctly segmented; second antennae turned across the frontal margin; second maxillae separate to their tips, bulla bell-shaped. Length of cephalothorax, 6.2 mm.; of trunk, 4.85 mm.; of ovisacs, 7.25 mm.

Male.—Unknown.

Remarks.—This is a very rare species, since the examination of many sting rays yielded but a single specimen.

BRACHIELLA MITRATA Wilson

FIGURE 310

Brachiella mitrata WILSON, Proc. U. S. Nat. Mus., vol. 47, p. 709, pls. 54, 55, 1915.

Occurrence.—Four females were taken from the gills of a tilefish (*Lopholatilus chamaeleonticeps*) by M. T. Thompson. The fish was captured on the edge of the continental shelf south of Woods Hole.

Distribution.—Not found outside the present area.

Color.—Body of preserved specimens a uniform brownish yellow.

Female.—Cephalothorax short and stout and inclined ventrally, so that the axis of the head is at right angles to that of the trunk; margin of carapace slightly raised. Trunk depressed, longer than wide, obliquely truncated posteriorly; genital process on a level with the ventral surface of the trunk with a small laminate posterior process on each side of it. First antennae 3-segmented, with two apical setae; exopod of second antenna 2-segmented; second maxillae short and separate to their tips, bulla button-shaped on a short stem. Length of cephalothorax, 2.35 mm.; of trunk, 3.65 mm.; of ovisacs, 5 mm.

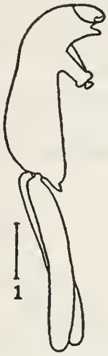

FIGURE 310.—*Brachiella mitrata:* Female, lateral

Male.—Unknown.

Remarks.—This species may be identified by the short and very thick neck and the minute laminate posterior processes.

BRACHIELLA ELEGANS Richiardi

FIGURE 311

Brachiella elegans RICHIARDI, Catalogo degli espositori, Berlin, p. 151, 1880.—WILSON, Proc. U. S. Nat. Mus., vol. 47, p. 707, pls. 54, 55, 1915.

Occurrence.—Both sexes were taken from the gills of an amberjack (*Seriola lalandi*) captured near Woods Hole.

Distribution.—Mediterranean (Richiardi, Carus, Brian).

Color.—Body of preserved specimens a uniform dark yellowish brown.

Female.—Cephalothorax short and depressed; head enlarged, with a large carapace; neck short, in line with the trunk axis; trunk elongate-triangular, widest across the posterior margin; dorsal posterior processes less than half the length of the ventral and inclined toward the ventral surface; a genital process on the midline between the ventral processes. First antennae 4-segmented; exopod of second antenna 2-segmented; second maxillae short, separate to their tips, bulla spherical. Length of cephalothorax, 2.15 mm.; of trunk, 4.5 mm.

Male.—Head with dorsal carapace, separated from trunk by a short neck; trunk spindle-shaped, ending in a conical median process; no caudal rami. First antennae 4-segmented; exopod of second antenna 2-segmented, with an apical tuft of setae; second maxillae exceptionally long and slender, more than twice the length of the maxillipeds, which are stout and triangular. Total length, 1.35 mm.

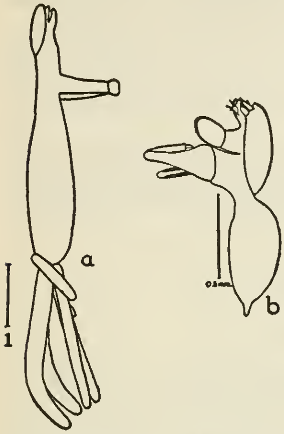

FIGURE 311.—*Brachiella elegans: a,* Female, lateral; *b,* male, lateral

Remarks.—In both sexes of this species the head, neck, and trunk are in line with one another. The host is a southern fish and was probably captured by Vinal Edwards at Katama Bay, the label being in his handwriting.

BRACHIELLA GULOSA Wilson

FIGURE 312

Brachiella gulosa WILSON, Proc. U. S. Nat. Mus., vol. 47, p. 705, pls. 53, 54, 1915.

Occurrence.—Both sexes were taken from the gills of the channel bass (*Sciaenops ocellata*) captured near Woods Hole.

Distribution.—New Jersey coast, North Carolina coast, off New York City, fish market, Washington, D. C. (Wilson).

Color.—Body of preserved specimens a light brownish yellow.

Female.—Cephalothorax stout, cylindrical, longer than trunk, and flexed backward; head enlarged, with a dorsal carapace; maxillary gland protruding on either side of the neck. Trunk narrowed and grooved dorsally where it joins the neck, inflated and depressed posteriorly; dorsal posterior processes a little shorter than ventral, a genital process between the latter. First antennae 3-segmented; exopod of second antennae 2-segmented, with two apical setae and a spiny knob; second maxillae quite short but separate to their tips, bulla button-shaped. Length of cephalothorax, 4.65 mm.; of trunk, 3.25 mm.

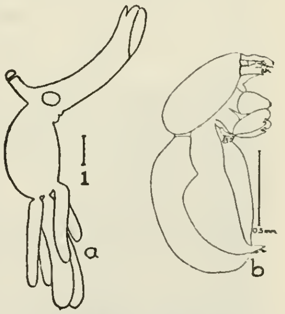

FIGURE 312.—*Brachiella gulosa: a,* Female, lateral; *b,* male, lateral

Male.—Head at an angle of 45° with the trunk axis, somewhat gibbous behind; trunk narrow ovate, terminating in a pair of small conical caudal rami. First antennae 3-segmented; both rami of second antennae 1-segmented, the exopod with a single apical spine; second maxillae a little longer than maxillipeds, the apical claw shutting into a socket on the inner margin of the basal segment. Total length, 1.45 mm.

Remarks.—The protruding maxillary glands on the sides of the neck and the relative length of the two pairs of posterior processes are the chief characteristics of this species.

Family SPHYRIIDAE

Genus PAEON Wilson, 1919

Female.—Body separable into head, neck, and trunk. Head enlarged into a transverse ellipsoid, the surface of which is raised into globular paired processes; neck slender and straight but usually showing torsion; trunk swollen and depressed, with a pair of posterior processes dorsal to the ovisacs. Abdomen minute, fused with the trunk and carrying a pair of globular caudal rami. No antennae; proboscis retractile; two pairs of mouth parts; no swimming legs.

Male.—Head elongate, covered with a carapace and gibbous posteriorly; one free thoracic segment, the others fused into a trunk with a pair of conical caudal rami and a pair of minute dactylose processes in front of them on the ventral surface. First antennae indistinctly segmented; second antennae biramose; four pairs of mouth parts, the basal segments of the maxillipeds completely fused, the terminal segments usually chelate. A single species here.

PAEON ELONGATUS, new species

PLATES 40, 41

Occurrence.—Both sexes were taken from the gill cavity of the brown shark (*Carcharhinus milberti*) and also from the gill cavity of the dusky shark (*C. obscurus*), both captured at Menemsha Bight, Marthas Vineyard. A single female with attached male has been selected for the holotype of the new species, with U.S.N.M. No. 56655.

Color.—Body a uniform milky white, the globular processes on the head usually tinged more or less deeply with reddish brown.

Female.—Head enlarged transversely into an ellipsoid, from the anterior and ventral surfaces of which project several pairs of globular processes. The first pair extend across the anterior margin and are nearly spherical, but their surfaces meet on the midline and are somewhat flattened. Behind them on the ventral surface is a transverse series of three knobs, the end ones subspherical, the middle one more or less angular. The four rounded corners of the ventral surface are also raised a little into globular knobs.

Between the inner ends of the anterior pair of knobs projects the mouth tube, and on its sides are the first pair of mouth parts, while the second pair are in the groove between the two anterior knobs and the median row of three knobs. Each second antenna on the side of the mouth tube is made up of a laminate basal portion and two rami. The endopod is 1-segmented, with a small spine on its inner surface, the exopod is 2-segmented, the basal segment wider and longer than the distal, which carries three apical spines. Each of the second pair of mouth parts has a swollen basal segment and a slender terminal claw; the latter is greatly thickened at its base and armed there with a minute accessory spine, then abruptly narrowed and curved into a sickle shape.

The neck is one-fifth of the width of the head and is at least half the entire length of the body; it may be comparatively smooth throughout or it may be rather profusely wrinkled. Where it joins the trunk it is always deeply wrinkled, for this is the portion in contact with the skin of the host, the head of the parasite and the neck anterior to this being buried in the tissues beneath the fish's skin.

The trunk is club-shaped, widening gradually and then narrowing to a rounded posterior end; the greatest width is about one-third of the length, and about the same distance in front of the posterior end. The divisions between segments in the trunk are indicated by definite breaks in the longitudinal musculature, and by more or less distinct marginal indentations. But only two actual transverse grooves are visible, one across the neck some distance behind the head, and the other near the anterior end of the trunk. That there is really an abdomen fused with that part of the trunk which represents the genital segment is indicated by another break in the longitudinal muscles. The surface of the trunk is smooth, and if the muscles are relaxed when the parasite is killed there are no pits at the ends of the dorsoventral muscles. But if the parasite dies with its muscles contracted, the entire dorsal and ventral surfaces of the trunk are covered with such pits. The posterior processes arise from the dorsal surface of the abdomen and are about half as long as the trunk, parallel and curved a little ventrally. The ovisacs are only half the diameter of the posterior processes, but are longer than the entire body, each containing about 1,000 eggs. Total length, 20–25 mm. Head, 2 mm. long; 3.5 mm. wide. Neck, 12 mm. long. Trunk, 9 mm. long. Ovisacs, 23–27 mm. long.

Male.—Head one-half longer than the trunk, its dorsal surface strongly inflated and covered with a carapace, both the carapace and the inflation ending abruptly opposite the bases of the second maxillae. The single free segment behind the head much longer than in the other two species of the genus. The remaining thoracic segments are completely fused without any indications of segmentation; at the posterior end is a pair of caudal rami close together on either side of the midline. In front of them on the ventral surface is a pair of short dactylose processes, bluntly rounded at their tips; the abdomen is lacking.

The first antennae are 3-segmented, with two spines on the end segment and one spine on the penultimate segment. The second antennae are broad and flattened, the basal portion 2-segmented, the endopod 1-segmented and bluntly rounded, with a spine on the inner margin near the tip. The exopod is 2-segmented, the end segment with a stout acuminate spine at its inner distal corner, a much smaller spine at the outer corner, and between them two still smaller spines. The first maxillae are tipped with three stout spines, the palp with a single short spine. The second maxillae are long and slender, each tipped with a stout curved claw, whose point shuts into a bipartite process on the end segment forming a chela. The basal segments of the maxillipeds are fused across the midline, the terminal claws are short and strongly curved. Total length, 1.6–1.8 mm.

Metanauplius larva.—Two of the adult females carried ripe eggs. which were successfully hatched on being placed in an aquarium. As these are the first embryos to be obtained of any species belonging to the family Sphyriidae, they become of considerable interest. As in the Lernaeopodidae the nauplius and metanauplius stages are passed inside the egg, and the larva escapes from the egg at the close of the metanauplius period ready to molt into the first copepodid, or free-swimming, stage.

The body of the metanauplius is stout and ellipsoidal, the head is still fused with the first segment, but the second segment and abdomen are well defined, and the latter carries a pair of caudal rami. The first antennae are 3-segmented; the end segment still retains its two apical setae but carries also a well-developed claw inside the skin. The second antennae are biramose, the exopod 5-segmented, each segment armed with a plumose seta, the endopod 1-segmented, retaining the two terminal setae but with a claw inside the skin as in the first pair. The first maxilla is a dactylose process tipped with two setae, removed to the vicinity of the lateral margin. The second maxillae and maxillipeds are each stout, uniramose, indistinctly 3-segmented, the end segment with a slender apical claw. The two pairs of swimming legs are very rudimentary, each leg consisting of a basal segment and two 1-segmented rami armed with long plumose setae; the caudal rami are as large as the leg rami and two of the apical setae on each ramus are enlarged at the base.

Copepodid larva.—The metanauplius larva has no sooner emerged from the egg than it molts into the first copepodid, or free-swimming, form. The body in this form is much elongated and depressed; the head is elliptical and more than twice as long as wide, the proportion being as 5:12. At about the center of each lateral margin is a distinct sinus with a short dorsal groove extending toward the midline but falling far short of it. This doubtless separates the cephalic area from the rest of the head. Anteriorly the head is narrowed and smoothly rounded, and the antennae, maxillae, and maxillipeds extend prominently beyond its margins. Inside and close to the frontal margin may be seen the mushroom tip of the frontal filament, the stalk of which extends far back into the posterior part of the head and is there coiled. The body behind the head is made up of four segments, the first two thoracic and bearing the swimming legs, the third the genital segment, and the fourth the abdomen bearing the caudal rami.

The first antennae are 3-segmented, the basal segment longer than either of the other two and armed with two setae on its outer margin; the second segment carries one outer seta, the third segment seven marginal setae. The second antennae are biramose, the exopod 1-segmented, globular and armed with three large setae, the endopod 2-segmented, the end segment with a spine at each distal corner and two smaller ones between them on the terminal margin. The first maxillae are biramose, the exopod 1-segmented with a spine on its outer margin, the endopod 2-segmented with three apical spines. The second maxillae are 2-segmented with a long and slender apical claw bent abruptly near its tip. The maxillipeds are shorter than the second maxillae, but are 3-segmented, with a short and nearly straight apical claw; the third segment carries a small seta on its inner margin.

Each swimming leg is made up of a basal portion which is 2-segmented and two 1-segmented rami; in the first legs the distal basipod segment is much smaller than the proximal segment and carries no outer seta, in the second legs it is fully as wide as the proximal segment and has an outer seta. In the first legs the exopod has two spines and four setae, the endopod has seven setae and no spines. In the second legs also the exopod has two spines and four setae, but the endopod has only five setae. Each caudal ramus carries seven setae, of which two have their basal half enlarged into flattened laminae, while the other five are slender and filiform. Total length, 0.5–0.6 mm.

Remarks.—This species is distinguished from *Paeon ferox*, which it most resembles, by its much smaller size and by the relative lengths of the ovisacs and posterior processes. In *ferox* these are about equal, while here the ovisacs are from three to five times as long as the processes.

Genus REBELULA Poche, 1902

Female.—Head cylindrical, elongate, soft, and often transversely wrinkled; neck narrow, cylindrical, fully chitinized, and armed at its anterior end with chitin knobs, large processes, or branched horns. Trunk heart-shaped, strongly depressed, its posterior corners broadly rounded; a pair of small median lobes at the bases of the ovisacs. Abdomen fused with the trunk and carrying a pair of posterior processes covered with respiratory cylinders. First antennae and first maxillae reduced to tiny knobs; second antennae in the form of spherical processes; second maxillae, maxillipeds, and swimming legs obsolete in the matured adult.

Male.—Head short, without a carapace, but with a large spherical swelling on each side posteriorly; thorax distinctly segmented; no abdomen but a pair of caudal rami. First antennae 3-segmented, the end segment with four or five apical setae; second antennae 4-segmented with an apical claw, the second segment showing the rudiments of an endopod; first maxillae biramose, the rami 1-segmented; second maxillae and maxillipeds with their basipod segments completely fused, the rami separate with stout apical claws.

KEY TO THE SPECIES (FEMALES)

1. Neck filose, straight, armed at anterior end with 3 or 4 short processes more or less spherical .... bouvieri (p. 528)
   Neck stout, twisted and wrinkled, armed at anterior end with small irregular knobs .... gracilis (p. 529)

REBELULA BOUVIERI (Quidor)

Figure 313

Hepatophilus bouvieri Quidor, Arch. Zool. Paris, ser. 5, vol. 10, p. xliii, figs. 5, 6, 1912.

Rebelula bouvieri Wilson, Proc. U. S. Nat. Mus., vol. 55, p. 579, pls. 53, 54, 1919.

Occurrence.—Both sexes were taken from the flesh of the common grenadier (*Macrourus bairdii*), captured off Marthas Vineyard.

Distribution.—Off the coast of New Jersey (Wilson).

Color.—Body of preserved specimens a uniform yellowish gray.

Female.—Head four times as long as wide, smooth, tapered; cephalon separated by a distinct groove; neck filiform, one-third the diameter of the head and armed at its anterior end with three spherical processes, one dorsal and two lateral; trunk cordate with four pits on each side of the dorsal and ventral surfaces, between the midline and lateral margin, usually arranged two anterior and two posterior. Ovisacs eight times as long as wide; each posterior process with 40 to 50 respiratory cones. Length of head, of neck, and of trunk, each 10–15 mm. Ovisacs, 30–40 mm. long.

Male.—Head as long as the rest of the body, its dorsal swellings not very prominent; thoracic segments increasing in diameter posteriorly. First antennae 3-segmented; second antennae 4-segmented, the rudimentary endoped given off near the base of the second segment; basipod segments of maxillipeds completely fused, first free segment armed with three short spines on its inner margin, the two proximal ones so close together as to touch at their bases. Total length, 3 mm.

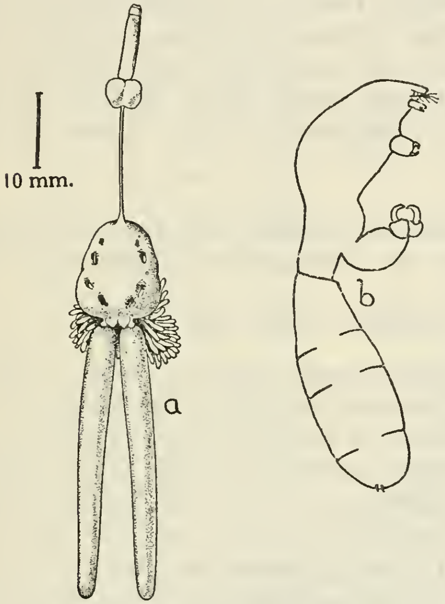

FIGURE 313.—*Rebelula bouvieri: a,* Female, ventral; *b,* male, lateral

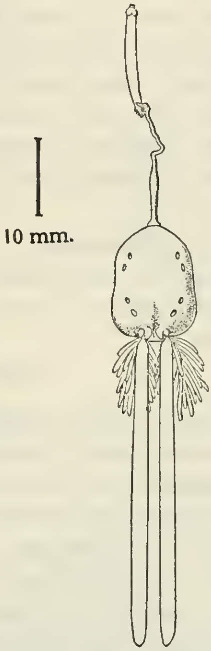

FIGURE 314.—*Rebelula gracilis:* Female, ventral

Remarks.—This parasite is buried in the flesh of its host near the dorsal fin, with only the trunk and egg strings visible. A dense cyst is usually formed around the head and neck of the copepod and often proves difficult to remove without injury to the copepod.

REBELULA GRACILIS Wilson

FIGURE 314

Rebelula gracilis WILSON, Proc. U. S. Nat. Mus., vol. 55, p. 585, pls. 53, 54, 1919.

Occurrence.—Two females were taken from the flesh of the long-nosed eel (*Synaphobranchus pinnatus*), captured off Marthas Vineyard by the *Albatross* in 1882.

Distribution.—Off the coast of New Jersey (Wilson).

Color.—Body of preserved specimens yellowish white, neck and trunk brownish, ovisacs a deep orange.

Female.—Head ten to fifteen times as long as wide, transversely wrinkled at the posterior end, where it is considerably narrower than the smooth anterior portion. Cephalon separated by a distinct groove and triangular, widest along the anterior margin and narrowed to a rounded point posteriorly. On each side of the head is a large padlike process, curved dorsally and ventrally and ending in bluntly rounded points. Neck slender anteriorly, where it is bent and twisted in many directions and armed with several minute chitin knobs, smooth, straight, and considerably widened posteriorly. Trunk obcordate, the pits smaller than in the preceding species and with their edges raised a little. Posterior processes half the length of the trunk and covered with elongated cones all about the same length. Ovisacs slender, at least twenty times as long as wide. Length of head, neck, and trunk, each 15 mm. Ovisacs, 42 mm. long.

Male.—Unknown.

Remarks.—The tiny 3-cornered cephalon and the narrow elongated neck and ovisacs are the distinguishing characters of this species.

Genus SPHYRION Cuvier, 1830

Female.—Cephalothorax transversely expanded into a pair of enormous lateral processes, forming the sphyra, or hammer, from the center of the anterior surface of which projects the head proper. Neck smooth and often enlarged posteriorly; trunk enlarged transversely and depressed; no abdomen, but a pair of knoblike caudal rami. The single pair of posterior processes profusely branched; ovisacs long and straight. In young females two pairs of antennae, two pairs of maxillae and a pair of maxillipeds, but no legs; in adult females some of or all these appendages replaced by simple processes or obsolete.

Male.—Head separated from trunk, on a level with the dorsal surface of the latter, the antennal area only covered with a minute carapace. Trunk folded upon itself and completely fused without distinction of parts; no abdomen, genital process, or caudal rami. Two pairs of antennae, two pairs of maxillae, and a pair of maxillipeds. A single species here.

SPHYRION LUMPI (Krøyer)

FIGURE 315

Lesteira lumpi Krøyer, Naturh. Tidsskrift, ser. 3, vol. 2. p. 325, pl. 18, fig. 5, 1863.

Sphyrion lumpi Wilson, Proc. U. S. Nat. Mus., vol. 55, p. 570, pls. 50–52, 1919.

Occurrence.—Found in limited numbers buried in the tissues of the rosefish (*Sebastes marinus*) captured off Cape Cod.

Distribution.—Danish coast (Krøyer, Steenstrup); English seas (T. and A. Scott); Greenland (Stephensen).

Color.—Young females and males a uniform snowy white; older females tinged more or less with brown, the color deepening with age.

Female.—Cephalothorax a little wider than the trunk, the lateral lobes sometimes enlarged into knobs, sometimes bifid; neck of medium width and varying length. Trunk more or less heart-shaped and strongly depressed; caudal rami small and laminate or knoblike; posterior processes becoming larger and more profusely branched with age. First and second antennae 3-segmented, the basal segment the largest; first maxilla a tiny knob easily overlooked; second maxilla a dactylose process tipped with a claw; maxillipeds with a swollen basal segment and a stout apical claw. Total length, 45–60 mm.

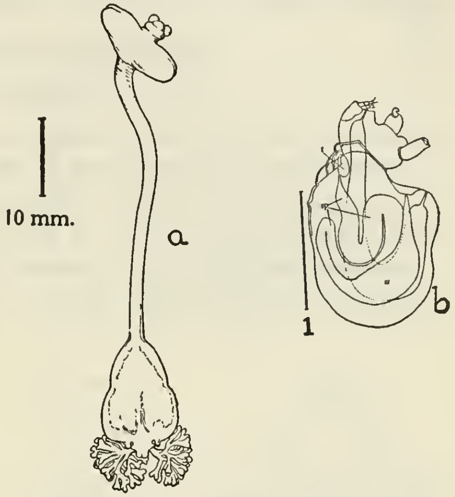

FIGURE 315.—*Sphyrion lumpi: a,* Female, dorsal (drawn by Rathbun); *b,* male, lateral

Male.—First and second antennae 3-segmented, first pair tipped with two stout spines, second pair with three spines; the second segment of the second pair has a wide process on the inner margin armed with three spines. Basal segments of maxillipeds fused across the midline, terminal segments slender and tipped with chelae. Total length, 2 mm. Greatest width, 1 mm.

Remarks.—This parasite can be recognized by the widened head and trunk connected by the long and comparatively narrow neck.

Family ANTHEACHERIDAE

Genus PHILICHTHYS Steenstrup, 1862

Female.—Head separated from first segment, small and rounded, without a carapace; no neck; trunk elongated, narrowed posteriorly and distinctly segmented, each segment being subdivided and all of them, including the head, furnished with paired lateral and ventral processes, which curve downward and inward. Anterior thorax swollen and orbicular, posterior portion cylindrical and tapered backward; abdomen short and segmented; no caudal rami. Antennae, mouth parts, and swimming legs entirely lacking.

Male.—Body slender, cylindrical, and distinctly segmented; head separated from first segment, without a carapace; first and second thoracic segments as wide as head, the others considerably narrower and passing insensibly into the abdomen, which is made up of four segments; caudal rami elongate and cylindrical. First antennae 6-segmented; second antennae 2-segmented, each tipped with two clawlike spines; second maxillae stout and armed with strong spines; maxillipeds small and feeble. A single species within the present area.

PHILICHTHYS XIPHIAE Steenstrup

FIGURE 316

Phylichthys xiphiae STEENSTRUP, Kongl. Vid. Selsk. Forh. 1861, p. 295, pl. 2, 1862. BERGSOE, Naturh. Tidsskrift, ser. 3, vol. 3, p. 87, pl. 13, 1864.

Occurrence.—Found free in the mucous canals of the head of the common swordfish captured off Marthas Vineyard.

Distribution.—Kattegat (Steenstrup, Bergsoe); Mediterranean (Richiardi, Valle, Carus); Belgian coast (Beneden); New Zealand (Thomson); English seas (T. and A. Scott); New England coast (Goode, Rathbun, Linton).

Color.—Body white, becoming a faint salmon-pink on the swollen lobes of the anterior thorax. The digestive canal shows as a dark line through the center of the body. The eggs are olivaceous, deepening with development; the eye is reddish.

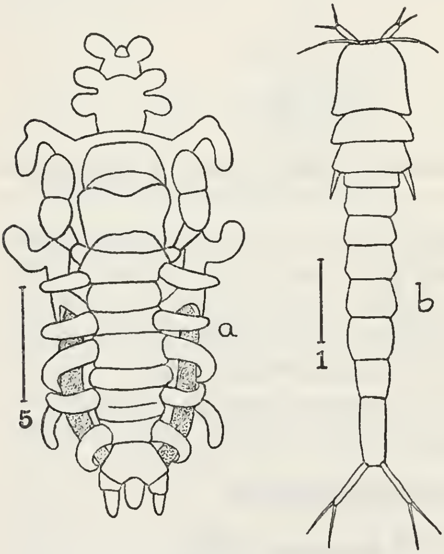

FIGURE 316.—*Philichthys xiphiae: a,* Female, dorsal; *b,* male, dorsal

Female.—Anterior cephalothorax composed of three small segments, the first very minute, the second bearing the mouth opening and the dorsal eye and anteriorly a knoblike process on each side of the first segment, the third segment larger with two dorsal processes on each side. Second and third thoracic segments enlarged into a disk, whose width is one-third the length of the whole body, each segment with a pair of irregularly branched ventral processes. Fourth, fifth, and genital segments about the same width and much narrower than the second and third segments, each with one or more pairs of lateral processes, which surround the ovisacs. Abdomen

3-segmented, the middle segment only half as wide as the other two, the end segment swollen at the base, with a pair of knobs on its dorsal surface, and a long dactylose posterior process. Each abdominal segment has a pair of lateral and a pair of ventral processes. Ovisacs attached to the oviduct openings by the center of one side, and extending both forward and backward along the sides of the body inside the curved processes, which hold them in place and protect them. Total length of five Woods Hole specimens: 14.5–18–18–22–27 mm. Width of second and third thoracic segments, 6–8 mm.

Male.—Head about as wide as long with smooth margins; second thoracic segment armed with a stout curved spine at each posterolateral angle. Genital segment a little longer but no wider than the fifth segment. Each caudal ramus five times as long as wide and tipped with two setae of equal length. Two pairs of biramose swimming legs, the exopod 2-segmented, the endopod 1-segmented, both rami well armed with spines and setae. Total length, 4–5 mm.

Remarks.—If more swordfish were examined for these parasites, they would probably be found in considerable abundance; they are easily recognized.

APPENDIX A

LOCATION AND DESCRIPTION OF PONDS OF THE AREA

The ponds of the Woods Hole area have been discussed, and under each species of pond copepod here described has been given a list of the ponds in which it has been found. It only remains, therefore, to locate the various ponds and to give such information concerning them as may have an influence upon their fauna. For a great majority of the ponds it has been considered sufficient to designate them as salt, brackish, or fresh, without giving the exact salinity. In a few instances, however, the name of the pond is misleading, or copepods have been found in it that do not elsewhere inhabit water of that salinity, and for these reasons the exact salinity is stated.

The names here given are those used by the people who live around the shores of the ponds and do not always correspond with those appearing on maps. In all instances of discrepancy both names are recorded in order to establish the identity of the pond.

PONDS IN WOODS HOLE

Eel Pond.—Salt water becoming brackish around the mouths of fresh-water brooks that empty into it. A large pond in constant communication with the ocean, containing much vegetation and with a muddy bottom.

Penzance Pond.—Salt water. A very small pond on Penzance Neck, filled by the tide at high water.

Little Harbor.—Salt water. A bay opening directly into Vineyard Sound and containing much vegetation.

Quissett Pond.—Brackish water. A small pond on the shore of Quissett Harbor just above high-tide level, but so near to Buzzards Bay as to catch the spray during a storm; filled with water plants.

Mill Pond.—Fresh water. Within the village of Woods Hole and filled with blanket algae.

Fresh Pond.—Salinity 0.4993. A small pond close to the ocean on the road leading from Woods Hole to Nobska Lighthouse; vegetation rather limited.

Lily Pond.—Fresh water. A very small pond filled with waterlilies just north of Nobska Lighthouse.

Small unnamed ponds beside the road leading from Woods Hole to Falmouth, most of them mere pools choked with vegetation.

PONDS IN FALMOUTH OUTSIDE OF WOODS HOLE

Ice Pond.—Fresh water. A small pond north of Quissett Harbor, shallow and full of vegetation.

Flax Pond.—Fresh water. Another small pond still farther north, also shallow and full of vegetation.

Lily Pond.—Fresh water. A small pond filled with waterlilies close to the shore of Buzzards Bay and just south of the Falmouth Arms Hotel.

Crockers Pond.—Fresh water. Situated north of West Falmouth Village, of medium size and quite deep, without much vegetation.

Sidleys Pond.—Fresh water. Situated in Falmouth Village, of medium size and fairly deep, with much marginal vegetation.

East Falmouth Pond.—Fresh water. Beside the State highway in East Falmouth, its outlet running into Green Pond; small and shallow.

Bournes Pond.—Fresh water. In the village of West Falmouth, of medium size, rather shallow, and filled with vegetation.

Mares Pond.—Fresh water. North of the road from East Falmouth to West Falmouth, half a mile in diameter, with a moderate quantity of vegetation.

Browns or Spectacle Pond.—Fresh water. East of Mares Pond, a little longer but not so wide and filled with vegetation.

Jenkins Pond.—Fresh water. North of Browns Pond and considerably larger; deep and clear and free from vegetation.

Jones Pond.—Fresh water. In Waquoit Village; of medium size, shallow, and filled with vegetation.

Lily Pond.—Fresh water. South of Ashumet Pond, small in size and very shallow, choked with vegetation to within 5 inches of the surface.

Oyster Pond.—Salinity 0.214. On the shore of Vineyard Sound, half a mile long, quarter of a mile wide, filled with floating algae.

Salt Pond.—Salinity 0.36. On the shore of Vineyard Sound east of Oyster Pond, its outer end opening into the ocean.

Little Pond.—Fresh water. On the shore of Vineyard Sound east of Falmouth Heights, a mile long, the outer end opening into the ocean, the inner end receiving a large brook, the pond filled with water bloom.

Great Pond.—Fresh water to salt water. On the shore of Vineyard Sound, 2 miles long by half a mile wide, the outer end open to the ocean, the inner end receiving a large stream; vegetation rather limited.

Green Pond.—Fresh water to salt water. On the shore of Vineyard Sound, 2 miles long, quarter of a mile wide, the outer end open to the ocean, the inner end receiving the outlet of East Falmouth Pond.

Waquoit Bay.—Fresh water to salt water. On the shore of Vineyard Sound, 2 miles long, a mile wide, the outer end open to the ocean, the inner end receiving the Quostinet River and a large brook.

Eel Pond.—Fresh water to brackish water. West of Waquoit Bay and connected with it by a wide outlet, and receiving at its upper end the Childs River, the outlet of John Pond.

PONDS ON CAPE COD OUTSIDE OF FALMOUTH

John Pond.—Mashpee. Fresh water. A mile and a half long and half a mile wide, comparatively free from vegetation.

Outlet Pond.—Fresh water. A pond only 100 feet in diameter close to the outlet to John Pond and choked with vegetation.

Mashpee or Wakeby Pond.—Fresh water. Really the two ends of the same pond, connected by a wide channel, filled with water bloom.

Santuit Pond.—Fresh water. In Mashpee, a mile long, half a mile wide, and full of vegetation.

Lovells Pond.—Barnstable. Fresh water. A circular pond a third of a mile in diameter and quite deep, with only a little vegetation.

Long Pond.—Newton Village, Barnstable. Fresh water. Three-quarters of a mile long, quarter of a mile wide, quite deep and free from vegetation,

Lower Cotuit Pond.—Barnstable. Fresh water. Three-fourths of a mile long, one-fourth of a mile wide, rather deep and free from vegetation.

Middle Cotuit Pond.—Barnstable. Fresh water. Three-fourths of a mile long. one-fourth of a mile wide, rather shallow and full of vegetation.

Upper Cotuit Pond.—Barnstable. Fresh water. One mile long, half a mile wide, deep and free from vegetation.

Chequaquet Lake or Great Pond.—Barnstable. Fresh water. Two miles long and two miles wide, deep and free from vegetation.

Crescent Lake or Long Pond.—Centerville, Barnstable. Fresh Water. Half a mile long, quarter of a mile wide, deep and free from vegetation.

Shallow Pond.—Barnstable. Fresh water. East of Great Pond, triangular, half a mile across, shallow and choked with vegetation.

Long Pond.—Brewster. Fresh water. Two and a half miles long, 1 mile wide, quite deep and free from vegetation.

Seymour or Bangs Pond.—Brewster. Fresh water. Circular, half a mile in diameter, quite deep and free from vegetation.

Pleasant Lake or Hinckleys Pond.—Harwich. Fresh water. Elliptical, half a mile in diameter, quite deep and free from vegetation.

Round Pond.—Fresh water. In Barnstable east of Lower Cotuit Pond, rather small and full of all kinds of vegetation.

Flax Pond.—Fresh water. In Bourne between North Pocasset and South Pocasset, quarter of a mile in diameter, and fairly clear of vegetation.

Red Brook Pond.—Fresh water. In Bourne at South Pocasset, formed by a dam across Red Brook, shallow and filled with vegetation.

Ashumet Pond.—Fresh water. In Mashpee west of John Pond, a mile long, half a mile wide, deep and clear.

Scargo Lake.—Fresh water. In Dennis Village, three-quarters of a mile long, half a mile wide, deep and clear.

Flax Pond.—Fresh water. In Dennis, north of Follins Pond, at the head of Bass River, a very small and weedy pond.

Clear Pond.—Chatham. Fresh water. Beside the road from Chatham to South Chatham, very small, with few water plants.

Weedy Pond.—Chatham. Fresh water. Not far from the preceding pond, also very small and choked with vegetation.

PONDS ON THE ELIZABETH ISLANDS

Rams Head Pond.—Rams Head Island, Hadley Harbor. Fresh water. Small and full of water plants of all kinds.

Uncatena Pond.—Uncatena Island. Fresh water. Small and shallow and free from vegetation.

Marys Lake.—Naushon Island. Fresh water. Quarter of a mile in diameter and shallow, free from vegetation.

Pond near lighthouse at Tarpaulin Cove, Naushon Island. Fresh water. Small and full of water plants.

Pond near the beach north of the wharf at Tarpaulin Cove. Fresh water. Very shallow, with coffee-colored water, and full of vegetation.

French Watering Place.—Southeast shore of Naushon Island. Fresh water. Of medium size and free from vegetation except in one corner.

West End Pond.—Naushon Island. Fresh water. Circular, quarter of a mile in diameter and very shallow, with considerable vegetation.

East End Pond.—Nashawena Island. Fresh water. Of medium size, shallow, and choked with vegetation.

Pond at southern end of Penikese Island. Fresh water. Small, very shallow and muddy, without vegetation.

Ice Pond.—Cuttyhunk Island. Fresh water. About 50 feet in diameter, very shallow and choked with vegetation.

Lower Gosnold Pond.—Cuttyhunk Island. Brackish water. Opening into the ocean at its southern end and rather free from vegetation.

Upper Gosnold Pond.—Cuttyhunk Island. Fresh water. Separated from Lower Gosnold Pond by a bank of earth 40 feet wide, and full of vegetation.

Cuttyhunk Pond.—Cuttyhunk Island. Salt water. The harbor of the island, open to the ocean, and very shallow except in the channel.

PONDS ON MARTHAS VINEYARD

Katama Bay.—Salt water. A widened thoroughfare between Marthas Vineyard and Chappaquiddick Island, open to the ocean at both ends.

Edgartown Great Pond.—Fresh water to salt water. Two miles long, a mile and a half wide; open to the ocean at the southern end, source of Edgartown water supply at the other end.

Pond in western outskirts of Edgartown, 150 feet in diameter, shallow, and full of water plants.

Sengekontacket Pond.—Salinity 29.65. Three miles long, two-thirds of a mile wide, open to the ocean near its center, shallow, and full of algae.

Farm Pond.—Salinity 13.03. Half a mile long, quarter of a mile wide, and full of water plants of all descriptions.

Oak Bluff Pond.—Salinity 28.15. A small pond covering an acre and open to the ocean.

Menemsha Bight.—Salt water. A large bay on the northwest shore where most of the pond nets for fishing are set.

Menemsha Pond.—Salt water. A large pond opening into the bight and extending nearly across the island to the southern shore.

Nashaquitsa Pond.—Brackish water. Really the southern portion of Menemsha Pond, since they open into each other.

PONDS ON CHAPPAQUIDDICK ISLAND

Poucha Pond.—Salinity 30.16. Opening into Cape Poge Bay and thence into the ocean, deep, and comparatively free from vegetation.

Brackish ponds.—A series of five unnamed ponds at the southern point and along the western shore of the island close to Katama Bay:

No. 1.—Half an acre in area, salinity 25.46, choked with vegetation, and covered with a thick algal scum.

No. 2.—Quarter of an acre in area, salinity 28.16, very shallow but free from vegetation, with a hard bottom.

No. 3.—Quarter of an acre in area, salinity 23.15, very shallow but free from vegetation, with a muddy bottom.

No. 4.—Half an acre in area, salinity 22.67, very shallow and full of vegetation, with a muddy bottom.

No. 5.—Quarter of an acre in area, salinity 20.54, rather shallow and full of vegetation, with a hard bottom.

APPENDIX B

KEYS TO THE SUBORDERS AND GENERA OF THE COPEPODA

The suborders here used are the same as those first proposed by G. O. Sars with two exceptions. First, nearly all investigators up to the present time have separated the Copepoda into the Eucopepoda and the Branchiura and followed with subdivisons. But these subdivisions were confined to the Eucopepoda and did not appear in the Branchiura, and all of Sars's groups belong to the former. Hence, the original separation into Eucopepoda and Branchiura seems superfluous and is here entirely omitted. Instead the Branchiura are made an eighth suborder, corresponding with Sars's seven groups, and this is called the Arguloida to conform with the other names. Again the name Lernaeoida, given by Sars to his last group, can not be retained because the genus *Lernaea*, for which it is named, belongs in the Caligoida, another of the groups. Hence the original name proposed by Sars has been changed to Lernaeopodoida.

No valid genus proposed prior to 1928 has been intentionally rejected. A few, as follows, have been necessarily omitted because it has been impossible to obtain sufficient data to include them properly in the key or even to determine their validity: *Ferroniera* Labbé, 1925; *Herouardia*, *Parametis*, *Portierella*, *Regis*, *Rhyncoceras* Labbé 1927. It is too much to hope that none have been accidentally overlooked; the author apologizes for such omissions, and they can be easily rectified by inserting the genus in its proper place in the key.

KEY TO THE SUBORDERS

1. A movable articulation between third and fourth thoracic segments; body more or less depressed; parasitic or free swimming ---------- 2
   A movable articulation between fourth and fifth thoracic segments; body depressed or cylindrical; parasitic, commensal, free swimming, or benthonic ---------- 3
   A movable articulation between fifth and sixth thoracic segments; body more or less depressed; free swimming only - **Calanoida** (p. 540)
   Body rigidly fused, without a movable articulation, often without segmentation; fixed parasites only ---------- 6
2. No second antennae or mouth parts; parasitic during development and free swimming in adult stage ---------- **Monstrilloida** (p. 604)
   Both second antennae and mouth parts present; free swimming during development, parasitic in adult stage ---- **Caligoida** (part) (p. 604)
3. Fifth and genital segments fused with abdomen and without segmentation; no fifth or sixth legs; parasitic ---------- **Arguloida** (p. 539)
   Fifth and genital segments distinctly separated; abdomen segmented; fifth and often sixth legs present ---------- 4
4. Urosome about as wide as metasome and both more or less cylindrical; basal segment of fifth legs with inner expansion. **Harpacticoida** (p. 560)
   Metasome much wider than urosome and depressed; basal segment of fifth leg without an inner expansion ---------- 5
5. First antennae usually elongate, prehensile or often not prehensile in male; eggs carried in lateral ovisacs ---------- **Cyclopoida** (p. 583)
   First antennae short, with few segments, always prehensile in male; eggs carried in dorsal ovisacs ----- **Notodelphyoida** (part) (p. 598)
6. Body rigid in both sexes; female a fixed parasite, male a pygmy attached to female ---------- **Lernaeopodoida** (p. 613)
   Body rigid in female only; male neither a pygmy nor attached to female, but belonging in 2 or 5 above ---------- 7
7. Eggs carried in external ovisacs; body depressed; external parasites of fishes, etc ---------- **Caligoida** (part) (p. 604)
   Eggs carried in a dorsal brood-pouch; body compressed; commensal in ascidians, etc ---------- **Notodelphyoida** (part) (p. 598)

KEY TO THE GENERA OF THE SUBORDER ARGULOIDA

1. Carapace orbicular, ovate, or elliptical; maxillipeds armed with a basal plate; caudal rami present ---------- 2
   Carapace drawn out into elongate lateral wings; no basal plate on maxillipeds; no caudal rami ---------- 4
2. Second maxillae transformed into prehensile disks ---------- 3
   Second maxillae normal, tipped with curved claws; no preoral sting in front of mouth ---------- ♂ ♀ **Dolops** Audouin, 1837
3. Two pairs of antennae; preoral sting present; basal plate of maxillipeds armed with teeth ---------- ♂ ♀ **Argulus** Müller, 1785 (p. 12)
   One pair of antennae; no preoral sting; basal plate of maxillipeds without teeth ---------- ♀ **Chonopeltis** Thiele, 1901
4. Rudiments of 2 pairs of antennae and a preoral sting; wings reaching beyond tip of abdomen ---------- ♀ **Dipteropeltis** Calman, 1912
   Antennae and preoral sting lacking; wings scarcely reaching base of abdomen ---------- ♀ **Talaus** Moreira, 1913

KEY TO THE GENERA OF THE SUBORDER CALANOIDA

(The swimming legs, especially the fifth pair, and the second antennae furnish the best distinctive characters in this group.)

1. Endopods of third and fourth swimming legs 3-segmented (see 85) -------- 2
Endopods of third and fourth swimming legs 2-segmented -------- 157
Endopods of third and fourth swimming legs 1-segmented -------- 177
Endopods of third legs 2-segmented, of fourth legs 3-segmented, exopods 3-segmented; first exopods 2-segmented, endopods 1-segmented; fifth legs uniramose, 3-segmented, no setae; bottom (Gulf of Guinea) -------- ♂ ♀ **Heteramalla** G. O. Sars, 1907
Endopods of third legs 2-segmented, of fourth legs 1-segmented, exopods 2-segmented; rami of first legs 3-segmented; fifth legs biramose, rami 1-segmented, armed with spines; surface (south Pacific) -------- ♂ ♀ **Guernella** Schmeil, 1897

2. Endopods of first swimming legs 3-segmented -------- 3
Endopods of first swimming legs 2-segmented -------- 58
Endopods of first swimming legs 1-segmented -------- 76

3. A circular brown spot (light organ) on right or left side of first segment; fifth legs uniramose, 2- to 4-segmented in female, 5-segmented in male, asymmetrical; pelagic.
♂ ♀ **Pleuromamma** Giesbrecht, 1898 (p. 123)
No circular brown spot on either side of first segment -------- 4

4. Basal segment of second endopod deeply invaginated, with spines on sides of invagination; fifth legs uniramose, 3- or 4-segmented in female, 5-segmented in male; pelagic, to 2,000 fathoms -------- ♂ ♀ **Metridia** Boeck, 1865 (p. 117)
No invagination and no spines on basal segment of second endopod -------- 5

5. Terminal exopod segment of third and fourth legs with 1 lateral spine, 1 at the distal corner, and 1 terminal -------- 6
Terminal exopod segment of third and fourth legs with 2 lateral spines, 1 at the distal corner, and 1 terminal -------- 22

6. Second basipod of first legs with a curved spine; no marginal teeth on third and fourth exopods in female; left fifth exopod in male without setae; pelagic (North Atlantic).
♂ ♀ **Neocalanus** G. O. Sars, 1925 (p. 27)
First legs without basipod spine; outer margins of third and fourth exopods toothed; fifth legs biramose, rami 3-segmented; first antennae asymmetrical; littoral -------- ♀ **Metranura** Brady, 1915
First legs without basipod spine; no marginal teeth on third and fourth exopods; first antennae symmetrical -------- 7

7. Urosome distorted; caudal rami asymmetrical; fifth legs of male uniramose, the right leg 5-segmented and chelate, the left leg 2-segmented and short; littoral -------- ♂ **Isocope** Brady, 1915
Urosome and caudal rami symmetrical; male fifth legs not as above -------- 8

8. Terminal spines of third and fourth exopods with both margins smooth -------- 9
Terminal spines of third and fourth exopods with one or both margins pectinate, denticulate, or setaceous -------- 12

9. Fifth legs with 3-segmented exopods and 2-segmented endopods, third exopod segment attached to center of second segment; exopod of second antenna with 2 segments; pearl-oyster washings ---------- ♀ **Ridgewayia** Thompson and Scott, 1903

Fifth legs with 2-segmented exopods, highly modified, and 1-segmented endopods; exopod of second antenna longer than endopod and made up of 7 segments (Suez Canal) - ♂ **Suezia** Gurney, 1927

Rami of fifth legs 3-segmented in both sexes and like the other legs ---------- 10

Rami of fifth legs unlike in two sexes and unlike the other legs ---------- 11

10. First basipod with hook and spine on anterior surface; basipod of fifth leg not denticulate; left fifth exopod prehensile in male; pelagic ---------- ♂ ♀ **Canthocalanus** A. Scott, 1909

First basipod without hook or spine; inner margin of fifth basipod denticulate; left fifth exopod in male natatory, not prehensile; pelagic ---------- ♂ ♀ **Calanus** Leach, 1819 (p. 19)

First basipod without hook or spine; inner margin of fifth basipods serrate; fifth legs natatory in female, prehensile and asymmetrical in male; pelagic ---------- ♂ ♀ **Nannocalanus** Sars, 1925

11. Middle segment of second exopod often invaginated; right fifth leg in male biramose, very short; left leg long, uniramose or biramose; pelagic, at surface --- ♂ ♀ **Undinula** A. Scott, 1909 (p. 29)

Middle segment of second exopod not invaginated; both fifth legs in male very long, exopods 3-segmented, right endopod 3-segmented, the left 1-segmented; pelagic, at surface. ♂ ♀ **Calanoides** Brady, 1883

12. Fifth legs uniramose in female, 3- or 4-segmented; biramose in male, endopod rudimentary or lacking, exopod 2- or 3-segmented, right one uncinate; fresh water. ♂ ♀ **Pseudodiaptomus** Herrick 1884 (p. 101)

Fifth legs uniramose in both sexes, 2-segmented in female, apical segment lamellar, 5-segmented in male, apical segment a slender, curved, smooth claw (Indian Ocean). ♂ ♀ **Metacalanus** Cleve, 1901

Fifth legs different from above ---------- 13

13. Caudal rami five to seven times as long as wide ---------- 14

Caudal rami only three times as long as wide, or less ---------- 16

14. Fifth legs biramose, rami 3-segmented, symmetrical in female, asymmetrical in male; fourth basipod in female with sword-like spine; fresh water (Australia) ----- ♂ ♀ **Gladioferens** Henry, 1919

Fifth legs in male biramose, asymmetrical, in female uniramose, symmetrical, 3-segmented, middle segment with inner spine and large process; brackish and salt water - ♂ ♀ **Poppella** Richard, 1888

Endopods of fifth legs 3-segmented in both sexes; exopods in females 3-segmented, middle segment with inner spine, in male 2-segmented, asymmetrical ---------- 15

15. Inner exopod spine of female fifth legs smooth; second basipod of right fifth leg of male with smooth margin; end claw of right exopod short; plankton of Great Lakes. ♂ ♀ **Limnocalanus** G. O. Sars, 1863

Inner exopod spine of female fifth legs with 2 rows of teeth; right fifth basipod of male with long process, end claw long and slender; fresh water (Asia) ----- ♂ ♀ **Sinocalanus** Burckhardt, 1913

16. Urosome of female 4-segmented, of male 5-segmented; rami of fifth legs 3-segmented, both sexes, except right exopod of male, which is short and 2-segmented; fresh water (North America)-------------------------- ♂ ♀ **Osphranticum** Forbes, 1882

Urosome of female 3-segmented, of male 5-segmented; fifth legs not as above-- 17

17. Fifth thoracic segment in female with 1 pair of asymmetrical posterior processes; fifth legs of male subequal in length-- 18

Fifth thoracic segment in female with 2 pairs of symmetrical posterior processes; fifth legs of male very unequal in length--------- 21

Fifth segment in female symmetrical, without processes; rami of fifth legs in female 3-segmented; in male right leg rami 3-segmented, left exopod 2-segmented, endopod 1-segmented; fresh water------------------- ♂ ♀ **Hemiboeckella** Sars, 1912

18. Fifth thoracic segment in female fused with fourth; right fifth endopod of male well developed and distinctly segmented-- 19

Fifth thoracic segment in female distinctly separated from fourth; right fifth endopod of male rudimentary, not segmented-- 20

19. Posterior processes of fifth segment in female simple, not reaching center of genital segment; right fifth leg of male longer than left; fresh water (Brazil)---- ♂ ♀ **Boeckellina** Mrázek, 1901[17]

Posterior processes of fifth segment in female reaching base of abdomen, left one bifurcate; left fifth leg of male longer than right; fresh water (Argentina)------ ♂ ♀ **Boeckellopsis** Mrázek, 1901[17]

20. End segment of fifth exopod in female with 4 inner setae; spine of second segment longer than segment; end claw of right fifth exopod in male segmented; fresh water (Patagonia). ♂ ♀ **Paraboeckella** Mrázek, 1901[17]

End segment of fifth exopod in female without inner setae; spine of second segment shorter than segment; end claw of right exopod in male not segmented; fresh water (Brazil). ♂ ♀ **Pseudoboeckella** Mrázek, 1901[17]

21. Inner spine of second segment of female fifth exopod twice as long as end segment; fifth endopods in male 3-segmented, armed with many plumose setae; fresh water (Patagonia). ♂ ♀ **Parabroteas** Mrázek, 1901

Inner spine of second segment of female fifth exopod not longer than end segment; fifth endopods in male rudimentary, 1-segmented, without setae; fresh water (Australia). ♂ ♀ **Boeckella** Guerne and Richard, 1889

22. First exopods 2- or 3-segmented; forehead with 2 conical processes; setae of both maxillae and maxillipeds densely plumose and stout; open ocean plankton--- ♀ **Bathycalanus** G. O. Sars, 1905

First exopods always 3-segmented; forehead with 1 process only; setae of maxillae densely, of maxillipeds sparsely, plumose and slender-- 23

First exopods always 3-segmented; forehead without a process; setae of both maxillae and maxillipeds sparsely plumose and slender-- 24

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[17] Of doubtful validity; if valid distinguished by characters here given.

23. Fifth legs biramose in both sexes, rami 3-segmented; posterior corners of metasome smoothly rounded or slightly angular; urosome symmetrical; open-ocean plankton.
♂ ♀ **Megacalanus** Wolfenden, 1904 (p. 26)
Fifth legs uniramose in both sexes, female 4-segmented, male 3-segmented; metasome with pointed posterior corners; urosome very asymmetrical; Antarctic plankton.
♂ ♀ **Gaussia** Wolfenden, 1905

24. First antennae do not reach posterior margin of head------------------ 25
First antennae reach third thoracic segment; rami of second antennae equal; fifth legs biramose, rami 3-segmented; body and appendages covered with hair; open-ocean plankton.
♀ **Centraugaptilus** G. O. Sars, 1920
First antennae reach the abdomen and often extend some distance beyond tips of caudal rami------------------------------- 27

25. Fifth legs uniramose in both sexes, 3-segmented in female, 5-segmented in male; right fifth leg of male with stout end claw, left leg with spatula; surface (North Atlantic).
♂ ♀ **Paramisophria** T. Scott, 1897
Fifth legs biramose in both sexes---------------------------------- 26

26. Rami of fifth legs 3-segmented in female, 1- or 2-segmented in male; exopod of second antenna 3-segmented, distal endopod segment at right angles to basal; littoral.
♂ ♀ **Pseudocyclops** Brady, 1872
Exopods of fifth legs 2-segmented, endopods 1-segmented, spine-like; exopod of second antenna 6-segmented, the two endopod segments in line with each other; littoral (Bahama Islands).
♀ **Rhapidophorus** Edwards, 1891

27. Left, and sometimes the right, caudal ramus with one seta much thicker than the others and greatly elongated ---------------------- 28
Setae of caudal rami neither enlarged nor greatly lengthened------------ 35

28. Exopod of second antenna much longer than endopod; urosome 4-segmented; fifth legs biramose, rami 3-segmented; maxillary palp with many lobes; open-ocean plankton.
♀ **Pontoptilus** G. O. Sars, 1905
Rami of second antennae about the same length--------------------- 29
Endopod of second antenna much longer than exopod; fifth legs biramose, rami 3-segmented ----------------------------------- 32

29. Middle segment of fifth exopod in female with smooth inner spine; second basipod of right fifth leg in male with sausage-shaped process--- 30
Middle segment of fifth exopod in female with denticulated inner seta; second basipod of right fifth leg in male without process-- 31

30. All the setae of second maxillae transformed into stout, curved spines; first antennae as long as entire body, or even longer; pelagic------------------ ♂ ♀ **Heterorhabdus** Giesbrecht, 1898 (p. 131)
Only the two end setae of second maxillae transformed into curved spines; first antennae scarcely reaching behind metasome; pelagic-------------------- ♂ ♀ **Macrorhabdus** G. O. Sars, 1920

31. Middle segment of fifth exopod in female with a group of large blunt spines on distal margin; first antennae twice as long as the body; open ocean plankton ----- ♀ **Heterostylites** G. O. Sars, 1920
Middle segment of fifth exopod in female with 3 tiny spines at outer distal corner; first antennae little longer than body; open-ocean plankton -------------------- ♂ ♀ **Disseta** Giesbrecht, 1889

32. Middle segment of fifth exopod in female with a smooth inner spine, end segment with 4 setae; caudal seta on left ramus only thickened -- 33
Middle segment of fifth exopod in female with inner plumose seta; end segment with 3 setae; 1 seta on each caudal ramus thickened; open-ocean plankton -- ♀ **Augaptilus** Giesbrecht, 1889 (p. 135)

33. Caudal rami symmetrical, outer seta at center of outer margin; second maxillae ending in 2 equal stout, thickly toothed spines; open-ocean plankton -------- ♂ ♀ **Mesorhabdus** G. O. Sars, 1905
Caudal rami asymmetrical, left longer than right --------------------- 34

34. Outer seta of caudal rami close to apical setae; second maxillae ending in long slender setae fringed with cilia; Antarctic plankton ----------------------- ♂ ♀ **Alloiorhabdus** Wolfenden, 1911
Outer seta of caudal rami removed from apical setae; second maxillae ending in stout, sickle-shaped, toothed claws; Antarctic plankton ------------------ ♂ ♀ **Hemirhabdus** Wolfenden, 1911

35. First antennae asymmetrical in both sexes, left larger than right; fifth legs uniramose, 3-segmented in female, 4-segmented in male; Norwegian fiords ------- ♂ ♀ **Scottula** G. O. Sars, 1902
Females only, first antennae symmetrical, fifth legs not as above -------- 36
Males only, first antennae asymmetrical, fifth legs not as above -------- 49

36. Fifth legs biramose and symmetrical, with plumose setae ------------- 37
Fifth legs uniramose or asymmetrical or both, often without setae -- 47

37. Both rami of fifth legs 3-segmented ------------------------------- 38
Both rami of fifth legs 2-segmented -------------------------------- 41
Exopods of fifth legs 3-segmented, endopods 2-segmented -------------- 44
Exopods of fifth legs 3-segmented, endopods 1-segmented -------------- 45

38. Middle segment of fifth exopod with large inner spine, end segment with denticulate terminal spine; exopod of second antennae 6-segmented, short; pelagic, at surface.
♀ **Centropages** Krøyer, 1849 (p. 85)
Middle segment of fifth exopod with inner awl-shaped or plumose seta, or with a naked inner margin; no denticulate terminal spines --- 39

39. Terminal segment of fifth endopod with 5 plumose setae; exopod of second antennae 8-segmented; fourth and fifth metasome segments fused and rounded; open-ocean plankton.
♀ **Lucicutia** Giesbrecht, 1898 (p. 128)
Terminal segment of fifth endopod with 6 or more setae; exopod of second antennae with 7 segments or less ------------------------ 40

40. Middle of forehead with knob or spiniform process; endopod of second antenna 3-segmented, four times as long as exopod; first basipod without hook; pelagic at surface.
♀ **Haloptilus** Giesbrecht,1898

Forehead smooth; endopod of second antenna 2-segmented, short; anterior surface of second basipod of first leg with a stout hook curved downward; open-ocean plankton. ♀ **Megacalanus** Wolfenden, 1904 (p. 26)

Forehead smooth; endopod of second antenna 3-segmented, not twice as long as exopod, often no longer; no hook on basipod of first legs; open-ocean plankton ------------ ♀ **Euaugaptilus** Sars, 1920

41. Urosome 4-segmented; rami of second antennae subequal in length -- 42

Urosome 3-segmented; rami of second antennae very unequal in length -- 43

42. Posterior corners of metasome with short, sharp spines; first and second segments of fifth exopod each with 2 or 3 spines at outer distal corner; open ocean ---- ♀ **Macrocalanus** G. O. Sars, 1905

Posterior corners of metasome rounded, without spines; first and second segments of fifth exopod each with 1 spine at the outer distal corner; open ocean --- ♀ **Pseudaugaptilus** G. O. Sars, 1907

43. Caudal rami usually as wide as long and obliquely truncated; masticatory lobe of first maxilla well developed, with stout spines; open ocean ---------------- ♀ **Euaugaptilus** G. O. Sars, 1920

Caudal rami usually much longer than wide and rounded; masticatory lobe of first maxilla rudimentary, with scattered setae only; open ocean -------- ♀ **Augaptilus** Giesbrecht, 1889 (p. 135)

44. End segment of second endopod with 4 setae; second basipod of first legs with rodlike process; second segment of fifth exopod with 2 outer smooth spines; open ocean. ♀ **Isochaeta** Giesbrecht, 1889

End segment of second endopod with 8 setae; no process on basipod of first leg; second segment of fifth exopod with a single outer denticulate spine; pearl-oyster washings. ♀ **Ridgewayia** Thompson and Scott, 1902

45. Fifth endopod reaching middle of second exopod segment; latter with a broad toothed inner spine; distal exopod segment with 4 inner setae; littoral, among algae --- ♀ **Isias** Boeck, 1865

Fifth endopod not reaching base of second exopod segment; latter with a slender and smooth inner spine ------------------------ 46

46. End segments of second, third, and fourth exopods with 5 inner setae; posterior corners of metasome with sharp spines; genital segment longer; pelagic ------------ ♀ **Pachyptilus** G. O. Sars, 1920

End segments of second, third, and fourth exopods with 6 inner setae; posterior corners of metasome without spines; genital segment wider; Antarctic plankton - ♀ **Pseudhaloptilus** Wolfenden, 1911

47. Fifth legs often asymmetrical, rami 3-segmented, end segment with 1 terminal spine, second segment with 2 inner setae; rami of second antennae about equal; pelagic - ♀ **Arietellus** Giesbrecht, 1892

Fifth legs always symmetrical, rami 1-, 2-, or 5-segmented ------------- 48

48. Rami of fifth legs 1- or 2-segmented, terminal segment with plumose setae; exopod of second antenna only half as long as endopod, or even less; open ocean ----- ♀ **Paraugaptilus** Wolfenden, 1904

Rami of fifth legs 5-segmented, terminal segment leaflike with serrated apex; endopod of second antenna half as long as exopod or less; open ocean ---------- ♀ **Phyllopus** Brady, 1883 (p. 136)

49. Right antenna modified for prehension---------------------------------- 50
Left antenna modified for prehension---------------------------------- 52

50. Both rami of fifth legs 3-segmented, endopods subsymmetrical, exopods asymmetrical; exopod of second antenna 8-segmented, shorter than endopod; open ocean- ♂ **Augaptilus** Giesbrecht, 1889 (p. 135)
Rami of fifth legs not segmented alike---------------------------------- 51

51. Exopods of fifth legs 2-segmented, right endopod lacking, left endopod laminate, 1-segmented; exopod of second antenna 5-segmented, basal segment long; littoral, among algae. ♂ **Isias** Boeck, 1865
Left 5th exopod 2-segmented, right 3-segmented; endopods symmetrical, 3-segmented; exopod of second antenna 6-segmented, its basal segment exceptionally short; pelagic, at surface------------------------- ♂ **Centropages** Krøyer, 1849 (p. 85)

52. Fifth legs subsymmetrical, rami 3-segmented with plumose setae--------- 53
Fifth legs decidedly asymmetrical, often without plumose setae--------- 55

53. Endopod of second antenna three or four times as long as exopod, latter 7-segmented; middle segment of right fifth exopod with smooth inner margin; pelagic- ♂ **Haloptilus** Giesbrecht, 1898
Rami of second antennae subequal, or endopod the longer; exopod 8-segmented; middle segment of right fifth exopod with a strong grasping process; open ocean. ♂ **Augaptilus** Giesbrecht, 1889 (p.135)
Exopod of second antenna much longer than endopod----------------- 54

54. Middle segment of right fifth exopod with small inner spine; end section of left antenna 4-segmented, first segment twice as long as second segment; open ocean-- ♂ **Pontoptilus** G. O. Sars, 1905
Middle segment of right fifth exopod with smooth inner margin; end section of left antenna 5-segmented, first segment scarcely longer than second; open ocean- ♂ **Heteroptilus** G. O. Sars, 1920

55. Exopods of fifth legs 3-segmented, endopods 1-segmented; posterior corners of metasome sharply pointed; forehead with wedge-shaped process; open ocean- ♂ **Arietellus** Giesbrecht, 1892
Both rami of fifth legs 3-segmented; posterior corners of metasome smoothly rounded; forehead smooth, without a wedge-shaped process; open-ocean plankton--- ♂ **Euaugaptilus** Sars, 1920
Exopods of one or both fifth legs 2-segmented, endopods 1-, 2-, or 3-segmented-- 56

56. Basipods, exopods, and endopods of fifth legs each 2-segmented but asymmetrical; end segments of exopods broad lamelliform, with narrow tips; open ocean------ ♂ **Paraugaptilus** Wolfenden, 1904
Basipods, exopods, and endopods of fifth legs not segmented alike--------- 57

57. Rami of left fifth leg 3-segmented, of right leg 2-segmented; distal segment of right exopod shutting down against the proximal, forming a chela; open ocean. ♂ **Lucicutia** Giesbrecht, 1898 (p. 128)
Exopods of fifth legs 3-segmented; right endopod lacking, left endopod 1-segmented, unarmed; right exopod not operating to form a chela; open ocean---- ♂ **Phyllopus** Brady, 1883 (p. 136)

58. Both rami of fifth legs 3-segmented, armed with plumose setae; exopod of second antenna 8-segmented; fourth and fifth body segments fused; open ocean -------- ♀ **Lucicutia** Giesbrecht, 1898 (p. 128)

Both rami of fifth legs 3-segmented in female, one or both 2-segmented in male; setae replaced by pectinated spines; exopod of second antennae 5-segmented; muddy bottom -------------------------------- ♂ ♀ **Platycopia** G. O. Sars, 1911

Endopods of fifth legs rudimentary or lacking; often the whole leg disappears on one or both sides -------------------------------- 59

59. Caudal rami at least six times as long as wide; fifth legs uniramose, 3-segmented in female; in male left leg 4-segmented, chelate, right 3-segmented; pelagic, at surface.
♂ ♀ **Temora** Baird, 1850 (p. 103)

Caudal rami only three times as long as wide or less ------------------ 60

Caudal rami fully as wide as long or wider ------------------------- 73

60. Middle segment of third endopod with 1, of fourth endopod with 2, setae; end segment of third endopod with 4, of fourth endopod with 3, setae, all plumose; fresh-water plankton.
♀ **Metaboeckella** Ekman, 1906

Middle segments of third and fourth endopods with 2, end segment with 7, setae -- 61

Middle segments of third and fourth endopods with 1, end segment with 5, setae -- 71

61. Terminal spine of second, third, and fourth exopods with its outer margin toothed or pectinated in both sexes; male with grasping antenna -- 62

Terminal spine of second, third, and fourth exopods with its outer margin smooth in both sexes; male without a grasping antenna -- 68

62. Both fifth legs uniramose, from 2- to 4-segmented -------------------- 63

One or both fifth legs biramose, with rudimentary endopod ------------ 64

63. Fifth legs in female 3-segmented, symmetrical; in male 4-segmented, asymmetrical; genital segment flattened ventrally, without a process; Arctic plankton ------ ♂ ♀ **Temorites** G. O. Sars, 1900

Fifth legs in female 3-segmented, asymmetrical; in male right leg 2-segmented, left 3-segmented; genital segment with large ventral process (South Atlantic) -------- ♂ ♀ **Temoropia** T. Scott, 1894

64. Fifth legs symmetrical in female, endopods 1- or 2-segmented, exopods 3-segmented; asymmetrical in male, endopods 1-segmented, exopods 2-segmented ---------------------------------- 65

Fifth legs symmetrical in female, endopods 1- or 2-segmented, exopods 2-segmented; asymmetrical in male, segmentation not as above -- 66

65. Urosome 2-segmented in female; fourth and fifth metasome segments more or less completely separated, the fifth with processes at posterior corners; fresh water (South Africa).
♂ ♀ **Paradiaptomus** G. O. Sars, 1895

Urosome 3-segmented in female; fourth and fifth metasome segments completely fused, the fifth with rounded corners, without the posterior processes; fresh water (Mongolia).
♂ ♀ **Hemidiaptomus** G. O. Sars, 1903

66. First antennae of female 25-segmented; urosome 3-segmented; right fifth exopod of male 2-segmented, endopod 1- or 2-segmented; rami of left leg 2- or 1-segmented; fresh water.
♂ ♀ **Diaptomus** Westwood, 1836 (p. 90)

First antennae of female 26-segmented; urosome 2-segmented; fifth legs of male not segmented as above---------------------------- 67

67. Right fifth exopod of male 2-segmented, with smooth end claw, endopod 3-segmented; left exopod 1-segmented, fused with basipod, endopod lacking; fresh water (Transvaal).
♂ ♀ **Adiaptomus** Cooper, 1906

Right fifth exopod of male 3-segmented, with serrated end claw, endopod 2-segmented; left exopod 2-segmented, separated from basipod; endopod lacking; fresh water (Transvaal).
♂ ♀ **Metadiaptomus** Methuen, 1910

68. Outer margin of second, third, and fourth exopods not toothed; fifth legs uniramose, 3- or 4-segmented in female; in male right leg 4-segmented, left leg 5-segmented; tropical oceans.
♂ ♀ **Calocalanus** Giesbrecht, 1888 (p. 39)

Outer margin of second, third, and fourth exopods toothed------------- 69

69. Fifth legs lacking in female or reduced to knobs; left leg only present in male; exopod of second antenna as long as endoped, 7-segmented; marine plankton---- ♂ ♀ **Acrocalanus** Giesbrecht, 1888

Both fifth legs present in male and female------------------------------- 70

70. Fifth legs uniramose, each 2-segmented in female; in male right leg 2-segmented, left 5-segmented; exopod of second antenna shorter than endopod, 7-segmented; marine plankton.
♂ ♀ **Paracalanus** Boeck, 1865 (p. 37)

Fifth legs uniramose in male, right leg 2-segmented, left leg 6-segmented; exopod of second antenna longer than endopod, but only 2-segmented; brackish water-- ♂ **Piezocalanus** Grandori, 1912

71. Exopod of first legs 3-segmented; fifth legs lacking in female-------------- 72

Exopod of first legs 3-segmented; fifth legs uniramose in female, 2-segmented; both fifth legs biramose in male, exopods 3-segmented, endopods 2-segmented; polar plankton.
♂ ♀ **Scaphocalanus** (part) G. O. Sars, 1900 (p. 76)

Exopod of first legs 2-segmented; fifth legs uniramose in female, 3-segmented; left leg biramose in male, right leg uniramose, with only 1 segment; marine plankton.
♂ ♀ **Rhincalanus** Dana, 1852 (p. 34)

72. Endopod of second antenna longer than exopod; end spines of second to fourth exopods with smooth margins; fifth legs uniramose in the male; marine plankton- ♂ ♀ **Eucalanus** Dana, 1852 (p. 30)

Exopod of second antenna longer than endopod; end spines of second to fourth exopods with 50 to 60 crowded teeth on their outer margins; Antarctic plankton- ♀ **Faroella** Wolfenden, 1904

73. Fifth legs entirely lacking in female, biramose in male, exopods 3-segmented, endopods 1-segmented, rudimentary; exopod of second antenna 7-segmented; deep-water plankton.
♂ ♀ **Pseudaetideus** Wolfenden, 1904

Fifth legs present and uniramose in both sexes-------------------------- 74

74. Rami of second antennae about equal in length, exopod 8-segmented; right fifth leg in male 4-segmented, left 5-segmented both legs in female 3-segmented; open ocean. ♂ ♀ **Bathypontia** G. O. Sars, 1905

Rami of second antennae very unequal, exopod 7-segmented or less -- 75

75. Exopod of second antenna longer than endopod; right fifth leg of male 3-segmented, left 4-segmented; each leg in female 3-segmented; Arctic plankton ---------- ♂ ♀ **Temorites** G. O. Sars, 1900

Endopod of second antenna longer than exopod; male unknown; maxillipeds with dense bundles of setae arranged like brush bristles; open ocean -------------- ♀ **Augaptilina** G. O. Sars, 1920

76. Endopod of second legs 3-segmented ---------------------------------- 77

Endopod of second legs 2-segmented ---------------------------------- 78

Endopod of second legs 1-segmented ---------------------------------- 140

77. Exopod of second antenna half as long as endopod, 7-segmented; urosome 3-segmented female, 4-segmented male; fifth legs symmetrical, 5-segmented both sexes; open ocean. ♂ ♀ **Mecynocera** Thompson, 1890 (p. 36)

Exopod of second antenna as long as endopod, 6-segmented; urosome 5-segmented in male; fifth legs asymmetrical, left 5-, right 4-segmented and swollen; Antarctic plankton. ♂ **Temoropsis** Wolfenden, 1911

78. End segments of second to fourth exopods each with 5 setae ------------ 79

End segments of second to fourth exopods each with 4 setae ------------ 86

All the legs without setae; exopod of second antenna 5-segmented, twice as long as endopod; fifth legs uniramose, right leg 5-segmented, left 2-segmented; Antarctic plankton. ♂ **Streptocalanus** Brady, 1918

79. Fifth legs lacking in female, male unknown ---------------------------- 80

Fifth legs present in female and in known males ---------------------- 83

80. Posterior surfaces of second to fourth legs without spines; urosome one-fifth as long as metasome; apical spines of exopods cultrated; marine plankton ---- ♀ **Mimocalanus** Farren, 1908

Posterior surfaces of second to fourth legs armed with spines ----------- 81

81. Head separated from first segment; fourth and fifth segments also separated; a crista on the forehead; rostrum stout and bifurcate; Antarctic plankton ------ ♀ **Hypsicalanus** Wolfenden, 1911

Head fused with first segment; fourth and fifth segments also fused; no crista -- 82

82. Rostrum stout, bifurcate; first basipod of fourth leg with row of 16 spines across its posterior surface and 7 on its inner margin; open ocean ------------------------------ ♀ **Oxycalanus** Farran, 1908

Rostrum lacking; first basipod of fourth leg with 1 inner seta only, no spines; spines on leg rami confined to the endopods alone; marine plankton ------------- ♀ **Spinocalanus** Giesbrecht, 1888

83. Rami of second antennae equal in length; fifth legs uniramose, 3-segmented -- 84

Exopod of second antenna definitely longer than the endopod ---------- 85

84. Head fused with first segment; fourth and fifth segments partially separated; caudal rami ciliated on inner margin; spine of fifth leg smooth; open ocean ------ ♀ **Farrania** G. O. Sars, 1920

Head separated from first segment, and fourth from fifth segment; caudal rami without cilia on inner margin; apical spine of fifth leg toothed; Antarctic plankton-- ♀ **Isocalanus** Wolfenden, 1911

85. Fifth legs 4-segmented in both sexes; endopod of third legs 2-segmented; fourth and fifth segments distinctly separated, the fifth often with wings; fresh and brackish water. ♂ ♀ **Eurytemora** Giesbrecht, 1881 (p. 107)
Fifth legs rudimentary or lacking in female, biramose in male; third endopod 3-segmented; fourth and fifth segments partly fused, without wings; open ocean---- ♂ ♀ **Monacilla** G. O. Sars, 1905

86. Posterior surface of rami of third and fourth legs armed with spines, often arranged in transverse rows and of large size----------- 87
Posterior surface of third and fourth legs smooth; without spines--------- 114

87. Fifth legs uniramose and symmetrical------------------------------ 88
Fifth legs uniramose and asymmetrical (see 105)------------------- 102
Fifth legs biramose, males only---------------------------------- 107
Fifth legs lacking, females only---------------------------------- 111

88. Each fifth leg 4-segmented, end segment with 3 denticulate setae; first antennae nearly reaching caudal rami; head and first segment fused; open ocean------ ♀ **Lophothrix** Giesbrecht, 1895
Each fifth leg 3-segmented-- 89
Each fifth leg 2-segmented-- 98
Each fifth leg 1-segmented-- 101

89. Head distinctly separated from first segment------------------------ 90
Head completely fused with the first segment------------------------- 95

90. Frons projecting like a capuchin cowl, covering 2 light organs; exopod of second antenna longer than endopod and made up of 6 segments; open ocean------- ♀ **Cephalophanes** G. O. Sars, 1907
Neither cowl nor light organs, but a normal rostrum------------------ 91

91. Apex of second maxilla with curved spines pectinate on their inner margins; head without frontal spine, usually without median crest-- 92
Apex of second maxilla with 1 stout claw, having smooth margins; head with or without frontal spine, usually with a median crest-- 93
Apex of second maxilla with neither claw nor pectinate spines; head with neither median crest nor frontal spine--------------------- 94

92. Upper surface of fifth legs with coarse hairs, inner margins dentate, without spines; end segment trilobate, with denticulate spines; open ocean---- ♀ **Xanthocalanus** Giesbrecht, 1892 (p. 68)
Upper surface of fifth legs smooth; inner margins each with 1 spine and a few small teeth; end segment conical, with smooth spines; Antarctic plankton-- ♀ **Talacalanus** Wolfenden, 1911 [18]

93. Head with or without a frontal spine; rostrum deeply bifurcate, with curved filaments; fifth legs with hairs on last 2 segments only; open ocean------------ ♀ **Cornucalanus** Wolfenden, 1905 (p. 74)
Head without a frontal spine; rostrum slightly bifurcate, no filaments; fifth legs with all 3 segments densely covered with long hairs; open ocean------------ ♀ **Onchocalanus** G. O. Sars, 1905

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[18] Validity doubtful, usually made a synonym of *Xanthocalanus*.

94. Upper surface of fifth legs covered with small spinules; end segment rounded and armed with 4 spines, 2 apical, 1 inner and 1 outer; open ocean------- ♀ **Brachycalanus** Farran, 1905 (p. 75)
Upper surface of fifth legs smooth, without spinules; end segment conically pointed and wholly without spines, apical or lateral; open ocean---------------- ♀ **Heteramalla** G. O. Sars, 1907
95. Rami of second antennae about equal in length; end segment of fifth legs with 3 denticulate setae; first antennae reaching the caudal rami; open ocean------------- ♀ **Lophothrix** Giesbrecht, 1895
Endopod of second antennae much longer and stouter than exopod; end segment of fifth legs with 2 slender smooth setae, the inner the longer; Antarctic plankton- ♀ **Drepanopsis** Wolfenden, 1911
Exopod of second antenna a third to a half longer than endopod---------- 96
96. Fourth and fifth segments separated, fifth without processes; end segment of fifth legs with 3 spines; exopod of second antenna with 7 segments; littoral----- ♀ **Pseudotharybis** T. Scott, 1909
Fourth and fifth segments fused, with acute posterior processes; end segment of fifth legs with a long curved spine and a short tooth; open ocean---- ♀ **Scottocalanus** G. O. Sars, 1905 (p. 80)
Fourth and fifth segments fused but without posterior processes--------- 97
97. End segment of fifth leg with tiny spine on outer margin, longer one at apex and still longer one on inner margin, curved and toothed; open ocean-------- ♀ **Scolecithricella** G. O. Sars, 1902 (p. 83)
End segment of fifth leg with spine and prong at apex and a spine on either margin, all 3 equal in length and none of them denticulate (Gulf of Gascogne)--------- ♀ **Neoscolecithrix** Canu, 1896
98. Head distinctly separated from first segment; posterior corners of fifth segment acute; end segment of fifth legs laminate, 4 setae (Mediterranean)---- ♀ **Xanthocalanus** Giesbrecht, 1892 (p. 68)
Head completely fused with the first segment-------------------------- 99
99. End segment of fifth legs digitiform and unarmed; basal segment thick, with densely crowded slender spines at inner distal corner (Norwegian coast)--- ♀ **Pseudophaenna** G. O. Sars, 1902
End segment of fifth legs invaginated on inner margin, with long inner and short apical spine; posterior corners of fifth segment pointed; Antarctic plankton-- ♀ **Racovitzanus** Giesbrecht, 1902
End segment of fifth legs neither digitiform nor invaginated, with 1 outer, 1 apical and 1 long denticulate inner spine------------ 100
100. Rostrum divided to its base, sinus slitlike; rostral rami passing insensibly into filaments; fifth leg spine twice as long as end segment; open ocean------ ♀ **Scaphocalanus** G. O. Sars, 1900 (p. 76)
Rostrum divided to its base, sinus broad; rostral rami passing abruptly into filaments; fifth leg spine shorter than the terminal segment; pelagic plankton------- ♀ **Amallothrix** Sars, 1925
Rostrum with shallow triangular sinus, its rami abruptly narrowed into filaments; fifth leg spine long as end segment; pelagic, at surface--------- ♀ **Scolecithricella** G. O. Sars, 1902 (p. 83)
101. Forehead with single circular organ; 1 seta of left caudal ramus thickened and lengthened; fifth leg with 2 unequal stout apical spines; open ocean---------- ♀ **Macandrewella** A. Scott, 1909
No organ on forehead; no thickened seta on either ramus; fifth leg with 1 tiny terminal and a long slender inner spine, both smooth; pelagic, at surface.
♀ **Scolecithricella** G. O. Sars, 1902 (p. 83)

102. Head distinctly separated from first segment------------------------ 103
Head completely fused with first segment--------------------------- 105

103. Right fifth leg 3-segmented, very short; left leg 5-segmented, elongated; fifth segment with rounded posterior corners; open ocean---------------- ♂ **Cornucalanus** Wolfenden, 1905 (p. 74)
Right fifth leg 4- or 5-segmented, left leg 5- or 6-segmented---------- 104

104. Each fifth leg 5-segmented, right leg reaching middle of third segment of left leg; metasome with rounded corners; caudal rami very short; tropical marine plankton---- ♂ **Phaenna** Claus, 1863
Left fifth leg 6-segmented, right 4-segmented, hardly reaching second segment of left leg; metasome with acute corners (Mediterranean)--------- ♂ **Xanthocalanus** Giesbrecht, 1892 (p. 68)

105. Fifth legs 5-segmented, not reaching caudal rami, basal portion not enlarged; second segment sometimes with rudimentary endopod; open ocean----------- ♂ **Chiridius** Giesbrecht, 1892 (p. 47)
Fifth leg not reaching caudal rami, basal portion not enlarged; right fifth leg 5-segmented, left 6-segmented; end segments acuminate; littoral------------- ♂ **Pseudophaenna** G. O. Sars, 1902
Fifth legs reaching beyond tips of caudal rami, their basal portion considerably enlarged-------------------------------------- 106

106. Enlarged base of fifth legs with pectinated spines; right fifth leg 3-segmented, left 4-segmented, the second segment with several outer processes; bottom, littoral---- ♂ **Diaixis** G. O. Sars, 1902
Enlarged base of fifth leg without spines; right fifth leg 5-segmented, left 3-segmented; end segment of right leg cultrate, of left leg lamellate; open ocean.
♂ **Scolecithricella** G. O. Sars, 1902 (p. 83)

107. Second basipod of right fifth leg much swollen proximally------------ 108
Second basipod of right fifth leg swollen little if at all---------------- 109

108. Exopods of fifth legs 2-segmented, right one bifurcate at apex, left one with apical tuft of hairs and a spine; endopods long and 1-segmented; open ocean------ ♂ **Macandrewella** A. Scott, 1909
Exopods of fifth legs 3-segmented; right endopod 2-, left 3-segmented; urosome 4-segmented; exopod of second antenna 6-segmented; head without a median crest; open ocean.
♂ **Scaphocalanus** G. O. Sars, 1900 (p. 76)

109. Head with low median crest; exopods of fifth legs 2-segmented, apical segment with 4 small spines; endopods 1-segmented, each with one spine; open ocean.
♂ **Brachycalanus** Farran, 1905 (p. 75)
Head without median crest; fifth legs not segmented as above-------- 110

110. Exopods of fifth legs 3-segmented, endopods 1- to 3-segmented, left one longer than left exopod; third segment of latter much narrowed; open ocean---------- ♂ **Lophothrix** Giesbrecht, 1895
Right fifth exopod 1- to 3-segmented, endopod 1- or 2-segmented; left exopod 2-segmented, endopod 1-segmented, shorter than exopod; latter not narrowed; open ocean.
♂ **Scottocalanus** G. O. Sars, 1905 (p. 80)

111. Fifth metasome segment with acute lamellar processes at posterior corners; rami of second antennae subequal, the exopod 7-segmented; bottom, littoral-- ♀ **Undinopsis** G. O. Sars, 1884
Fifth metasome segment with rounded posterior corners------------- 112

112. Head fused with first thoracic segment; urosome as wide as metasome, one-fourth as long; no spines on the posterior surface of fourth basipod; pelagic, near surface.
♀ **Scolecithrix** Brady, 1883 (p. 81)
Head distinctly separated from first thoracic segment; urosome much narrower as well as shorter than the metasome ---------- 113

113. Metasome twice as long and three times as wide as urosome; first basipod of fourth legs with many spines on posterior surface; tropical marine plankton - ♀ **Euchirella** Giesbrecht, 1888 (p. 55)
Metasome four times as long and five times as wide as urosome; posterior surface of fourth basipod smooth, without spines; tropical marine plankton ---------- ♀ **Phaenna** Claus, 1863

114. Basipod and exopod of second and third legs wider than in fourth legs; fifth legs uniramose, in female 3-segmented, in male left 5-segmented, right 1- to 3-segmented; open ocean.
♂ ♀ **Clausocalanus** Giesbrecht, 1888 (p. 42)
Basipod and exopod of second and third legs like those of fourth legs ---------- 115

115. Fifth legs uniramose and symmetrical, females only ---------- 116
Fifth legs uniramose and asymmetrical, both sexes ---------- 120
One or both fifth legs biramose, males only ---------- 128
Fifth legs wholly lacking, females only ---------- 131

116. First antennae reaching at least to the genital segment; exopod of second antennae 6-segmented ---------- 117
First antennae not reaching beyond posterior margin of head; exopod of second antennae usually 7-segmented ---------- 119

117. Head with dorsal carina and frontal crest; rami of second antennae subequal; fourth and fifth body segments fused with sharp posterior corners; polar plankton.
♀ **Amallophora** T. Scott, 1894
Neither carina nor crest; rami of second antennae subequal; fourth and fifth segments separated, fifth with 2 spines on each corner; fifth legs 3-segmented; bottom, littoral.
♀ **Oothrix** Farran, 1905
Neither carina nor crest; exopod of second antenna twice as long as the endopod ---------- 118

118. End segment of fifth legs digitiform, not so long as the 2 proximal segments combined; fifth metasome segment with pointed corners; bottom, littoral -- ♀ **Pseudophaenna** G. O. Sars, 1902
End segment of fifth legs laminate, twice as long as 2 proximal segments combined; fourth and fifth segments fused with rounded posterior corners; littoral, marine - ♀ **Tharybis** G. O. Sars, 1902

119. Basal segments of fifth legs each with inner spine; exopod of second antenna 6-segmented, shorter than endopod; fifth segment with rounded corners; littoral, marine.
♀ **Pseudocyclopia** T. Scott, 1892
No inner spines on fifth basipods; exopod of second antenna 7-segmented, longer than endopod; fifth segment with pointed posterior corners (Scottish seas).
♀ **Pseudotharybis** T. Scott, 1909

120. Females, fifth legs asymmetrical in segments, or length, or both ---------- 121
Males, fifth legs asymmetrical, but not swollen or misshapen ---------- 122
Males, fifth legs conspicuously swollen and misshapen ---------- 125

121. Fifth legs 3-segmented, apical segments denticulate, left leg longer than right; urosome segments fringed posteriorly with spines; littoral, marine-------- ♀ **Parastephos** G. O. Sars, 1902

Left fifth leg 2- to 4-segmented, right leg lacking; urosome segments not fringed with posterior spines; outer caudal setae lacking; tropical, marine------ ♀ **Ctenocalanus** Giesbrecht, 1888

122. Exopod of second antenna 7-segmented; right fifth leg 4-segmented-- 123

Exopod of second antenna 6-segmented; right fifth leg 3- or 5-segmented-- 124

123. Left fifth leg 6-segmented; tip of right leg reaching third segment of left leg; posterior corners of metasome sharply pointed; littoral, marine-------------- ♂ **Undinopsis** G. O. Sars, 1884

Left fifth leg 5-segmented; tip of right leg reaching fourth segment of left leg; posterior corners of metasome evenly rounded; open ocean---------- ♂ **Pseudocalanus** Boeck, 1872 (p. 43)

124. Right fifth leg 3-segmented, its tip reaching third segment of left leg; the latter 6-segmented; endopod of second antenna with 15 end setae; littoral, marine.
♂ **Microcalanus** G. O. Sars, 1901

Right fifth leg 5-segmented, its tip reaching fifth segment of left leg; the latter 6-segmented; endopod of second antenna with only 8 setae; bottom, littoral- ♂ **Pseudophaenna** G. O. Sars, 1902

125. Left fifth leg swollen, right slender, with or without a claw----------- 126

Basipod only of left leg swollen, but both legs misshapen------------- 127

126. Right fifth leg 4-segmented, without a claw; left leg 5-segmented, apical appendages leaf-like; third segment the largest, without a lamella; bottom plankton- ♂ **Stephos** T. Scott, 1892

Right fifth leg 4-segmented, with denticulated claw; left leg 5-segmented, no leaf-like appendages; second segment the largest, with a lamella; bottom plankton.
♂ **Parastephos** G. O. Sars, 1902

127. Swollen basipod with pectinated row of spines; right leg 2-segmented, left 4-segmented, its second segment with irregular processes; bottom plankton------- ♂ **Diaixis** G. O. Sars, 1902

Swollen basipod without spines; right leg 4-segmented, left 5-segmented, no processes on second segment; left end segment small and cochlear; littoral-- ♂ **Pseudocyclopia** T. Scott, 1892

128. Right fifth leg uniramose, 3-segmented, left biramose, exopod 3-segmented, endopod 1-segmented; fifth legs reaching beyond tips of caudal rami; littoral---- ♂ **Tharybis** G. O. Sars, 1902

Both fifth legs biramose, exopods 3-segmented, endopods 1-segmented, rudimentary; right leg longer than left and ending in a claw; bottom plankton---- ♂ **Undinopsis** G. O. Sars, 1884

Both fifth legs biramose, asymmetrical, not segmented as above-- 129

129. Forehead with median spine, without a crest; endopods of fifth legs 1-segmented, right exopod 2-segmented, left 3-segmented, end segment spiniform; open ocean.
♂ **Gaetanus** Giesbrecht, 1888 (p. 50)
Forehead without spine but with crest; fifth endopods 1-segmented, right one clavate; exopods 3-segmented, left with a claw; open ocean------- ♂ **Chirundina** Giesbrecht, 1895 (p. 48)
Forehead smooth, with neither spine nor crest---------------------- 130

130. Endopods of fifth legs 1-segmented, exopods 2-segmented; right leg the longer; exopod of second antenna 7-segmented and longer than endopod; fresh water-------- ♂ **Senecella** Juday, 1925
Endopods of fifth legs 1-segmented; right exopod 2-segmented, left 3-segmented; exopod of second antenna 6-segmented, one-half longer than the endopod; open ocean.
♂ **Drepanopus** Brady, 1883

131. Forehead with median spine; posterior corners of metasome with spines; first exopod 2- or 3-segmented, second endopod 1- or 2-segmented (fusion); open ocean.
♀ **Gaetanus** Giesbrecht, 1888 (p. 50)
Forehead without spine; first exopod always 3-segmented----------- 132

132. Posterior corners of metasome smoothly rounded------------------- 133
Posterior corners of metasome produced into spines or points--------- 137

133. Exopod of second antenna 7-segmented, as long as endopod; rostrum lacking; maxillipeds enormously enlarged; urosome short and weak; open ocean------ ♀ **Pseudeuchaeta** G. O. Sars, 1905
Exopod of second antenna 6 or 7 segmented; maxillipeds of normal size-- 134

134. Caudal rami as wide as long; second exopod segment of second antenna with only weak setae, or wholly without setae------------ 135
Caudal rami much longer than wide; second exopod segment of second antenna with 3 stout inner setae----------------------- 136

135. Exopod of second antenna 6-segmented, its second segment without setae; end spines of second, third, and fourth exopods laminate, teeth coarse; littoral.
♀ **Microcalanus** G. O. Sars, 1901
Exopod of second antenna 7-segmented, its second segment with setae; end spines of second, third, and fourth exopods cylindrical, teeth fine (North Atlantic)----- ♀ **Bradyetes** Farran, 1905

136. Caudal rami half longer than wide, ciliated on inner margins; metasome three times as long as urosome; anal and preanal segments equal; fresh water--------------- ♀ **Senecella** Juday, 1925
Caudal rami twice as long as wide, without cilia; metasome not twice as long as urosome; preanal segment much longer than anal; open ocean------------- ♀ **Pseudocalanus** Boeck, 1872 (p. 43)

137. Rami of second antennae subequal; posterior corners of metasome extending backward beyond distal margin of the genital segment; bottom plankton----- ♀ **Undinopsis** G. O. Sars, 1884
Endopod of second antenna longer than exopod; fourth and fifth metasome segments fused, their posterior corners turned upward; bottom plankton------- ♀ **Comantenna** Wilson, 1924
Exopod of second antenna longer than endopod------------------- 138

138. A triangular lappet on inner margin of second exopod segment of second antenna and on posterior margin of basal segment of maxilliped; Antarctic plankton----- ♀ **Mesogaidius** Wolfenden, 1911

Inner margin of second exopod segment of second antenna and posterior margin of basal segment of maxillipeds smooth, without lappets---------- 139

139. Rostrum divided to its base, or lacking; fourth and fifth metasome segments completely fused, with spines at their posterior corners; open ocean-------- ♀ **Chiridius** Giesbrecht, 1892 (p. 47)

Rostrum short, undivided; fourth and fifth segments distinctly separated, the latter produced into strong spines at its corners (South Pacific)---------- ♀ **Gaidiopsis** A. Scott, 1909

140. Fifth legs wholly lacking, females only---------- 141

Fifth legs present, both sexes included---------- 152

141. Fifth metasome segment with long, sharply pointed processes at its posterior corners, extending backward---------- 142

Fifth segment rounded or only slightly angular at its corners---------- 146

Fifth segment produced laterally into short spines with broad bases; end spines of second to fourth exopods with 50–60 teeth (North Atlantic)---------- ♀ **Faroella** Wolfenden, 1904

142. Rostrum strong and bifurcate, with stout rami---------- 143

Rostrum weak, rami minute or usually lacking---------- 145

143. Fourth and fifth metasome segments fused, the processes at their corners reaching behind the distal margin of the genital segment; open ocean---------- ♀ **Aetideus** Brady, 1883 (p. 44)

Fourth and fifth segments distinctly separated, the processes shorter---------- 144

144. Posterior processes of fifth segment reaching center of genital segment; exopods of first and second legs each made up of 3 segments; open ocean---- ♀ **Aetideopsis** G. O. Sars, 1903 (p. 46)

Posterior processes of fifth segment not reaching genital segment; exopods of first and second legs each made up of only 2 segments; open ocean---------- ♀ **Valdiviella** Steuer, 1904

145. Exopods of first legs 3-segmented; exopod of second antenna one-half longer than endopod; fifth body segment with short spines at its corners; open ocean-- ♀ **Chiridius** Giesbrecht, 1895 (p. 47)

Exopod of first legs 2-segmented; exopod of second antenna scarcely longer than endopod; fifth body segment with long spines at its corners; open ocean-- ♀ **Gaidius** Giesbrecht, 1895 (p. 52)

146. Ventral protuberance on genital segment large and prominent; inner seta of caudal rami hairlike, lengthened, geniculate---------- 147

Protuberance on genital segment small or lacking; no geniculate setae; metasome and genital segment symmetrical---------- 148

Protuberance on genital segment small; no geniculate setae; corners of metasome and genital segment asymmetrical; head with crest; Antarctic plankton.
♀ **Mesundeuchaeta** Wolfenden, 1911

147. Spines on distal segments of second maxillae with dense fringe of short spinules; posterior corners of metasome with long hairs; open ocean---------- ♀ **Paraeuchaeta** A. Scott, 1909 (p. 65)

Spines on distal segments of second maxillae with long scattered spinules; posterior corners of metasome usually without hairs; open ocean-------- ♀ **Euchaeta** Philippi, 1843 (p. 62)

148. Inner margin and posterior surface of first basipod of fourth leg smooth and naked, or with cilia only---------- 149
Inner margin and posterior surface of first basipod of fourth leg armed with teeth or coarse spines---------- 151

149. Exopod of first legs 1-segmented; forehead without a crest; rostrum lacking; endopod of second legs 1-segmented and short; body depressed; open ocean---- ♀ **Chiridiella** G. O. Sars, 1907
Exopod of first legs 2-segmented; forehead with or without a crest---------- 150

150. Forehead with a crest; caudal rami with dense tufts of hairs on inner margins; endopod of second antenna with 11 apical setae; open ocean---------- ♀ **Chirundina** Giesbrecht, 1895 (p. 48)
Forehead with or without a crest; caudal rami with ciliated inner margins; endopod of second antenna with 14 apical setae; open ocean---------- ♀ **Undeuchaeta** Giesbrecht, 1888 (p. 60)

151. Endopod of second antenna rudimentary, one-fourth as long as exopod or less; fourth and fifth metasome segments fused; exopod of first legs 2-segmented; open ocean. ♀ **Euchirella** Giesbrecht, 1888 (p. 55)
Endopod of second antenna scarcely shorter than exopod; fourth and fifth segments distinctly separated; exopod of first legs 3-segmented; open ocean--- ♀ **Pseudochirella** G. O. Sars, 1920

152. Fifth metasome segment with its posterior corners mucronate---------- 153
Fifth metasome segment with rounded posterior corners, sometimes armed with tufts of fine hairs---------- 154

153. Right fifth leg lacking, left uniramose, 5-segmented, reaching caudal rami; rostrum lacking; urosome 5-segmented, with a short anal segment; open ocean---- ♂ **Aetideus** Brady, 1883 (p. 44)
Both fifth legs present, biramose; endopods 1-segmented, right exopod 2-segmented, left 3-segmented; rostrum present; anal segment almost obsolete; open ocean. ♂ **Gaidius** Giesbrecht, 1895 (p 52.)

154. Left fifth exopod ending in a complicated hand for grasping spermatophore; left endopod rudimentary, often lacking---------- 155
Left fifth exopod without a grasping hand; left endopod always present and well developed, making both legs biramose---------- 156

155. Spines on distal segments of second maxillae with a dense fringe of short spinules; corners of metasome asymmetrical, left the larger; open ocean---- ♂ **Paraeuchaeta** A. Scott, 1909 (p 65)
Spines on distal segments of second maxillae with long scattered spinules; posterior corners of metasome symmetrical and smooth; open ocean---------- ♂ **Euchaeta** Philippi, 1843 (p. 62)

156. End segment of right fifth exopod elongate-acuminate, somewhat curved and regularly serrated on the concave margin; left endopod long; open ocean-- ♂ **Euchirella** Giesbrecht, 1888 (p. 55)
End segment of right fifth exopod short, bluntly rounded, and not toothed on its inner margin; left endopod relatively shorter; open ocean---------- ♂ **Undeuchaeta** Giesbrecht, 1888 (p. 60)

157. Endopod of first legs made up of 3 segments---------- 158
Endopod of first legs made up of 2 segments---------- 164
Endopod of first legs made up of 1 segment---------- 174

158. Head with one or two pairs of dorsal cuticular lenses and with a curved spine or hook on each lateral margin---------- 159
Head with neither dorsal lenses nor lateral spines---------- 161

159. Two pairs of lenses; rami of female fifth legs very unequal; the right fifth leg in male with weak chela, finger and thumb obtuse; open ocean........ ♂ ♀ **Anomalocera** Templeton, 1837 (p. 142)

Only 1 pair of lenses; fifth legs biramose in female, rami 1-segmented; uniramose in male, 3-segmented, asymmetrical, right leg without a chela (North Pacific). ♂ ♀ **Epilabidocera**, new name [19]

Only 1 pair of lenses; right fifth leg in male with stout chela, having a sharp-pointed finger and thumb; left leg uniramose 160

160. Fourth and fifth metasome segments fused; first antenna of female 22-segmented; apical section of grasping antenna of male with 4 segments; open ocean......... ♂ ♀ **Ivellopsis** Claus, 1893

Fourth and fifth metasome segments separated; first antenna of female 24-segmented; apical section of male grasping antenna with 2 segments; open ocean.. ♂ ♀ **Pontella** Dana, 1846 (p. 149)

161. Rami of second antenna subequal, or exopod longer than endopod 162

Endopod of second antenna much longer than exopod............ 163

162. Fifth legs uniramose and 3-segmented in both sexes; urosome 3-segmented in female, 4-segmented in male; exopod of second antenna with 7 segments; open ocean. ♂ ♀ **Neopontella** A. Scott, 1909

Fifth legs biramose, rami 1-segmented in female, uniramose and 3-segmented in male; urosome 5-segmented in male; exopod of second antennae 5-segmented; open ocean. ♂ ♀ **Parapontella** Brady, 1878

163. Urosome asymmetrical; fifth legs in female biramose, rami 1-segmented, exopod twice as long as endopod; in male uniramose and 3-segmented; open ocean. ♂ ♀ **Pontellopsis** Brady, 1883 (p. 157)

Urosome symmetrical; fifth legs in female biramose, 1-segmented, exopod four times as long as endopod; in male uniramose and 4-segmented; open ocean. ♂ ♀ **Pontellina** Dana, 1852 (p. 155)

164. Head with one pair of dorsal lenses; fifth legs biramose in female, rami 1-segmented and unequal; right leg uniramose in male, with chela; open ocean.. ♂ ♀ **Labidocera** Lubbock, 1853 (p. 144)

No dorsal lenses; fifth legs obsolete in female; in male biramose, rami 1-segmented, no chela; urosome in female 2-segmented, in male 3-segmented; littoral (Tasmania).. ♂ ♀ **Diarthropus** Brady, 1918

No dorsal lenses; fifth legs not segmented as above............ 165

165. Fifth legs biramose in one sex, uniramose in the other............ 166

Fifth legs biramose in both sexes............ 168

Fifth legs uniramose in both sexes............ 169

Fifth legs biramose, rami 1-segmented in female; male unknown; exopod of second antenna 8-segmented; first antennae reaching beyond caudal rami (North Pacific). ♂ **Pseudolovenula** Marukawa, 1921

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[19] *Paralabidocera* McMurrich, 1916, was preoccupied by Wolfenden in 1908 for a very different genus of copepods (see 167 in this key). This new name is substituted for McMurrich's genus.

166. Fifth legs uniramose, 3-segmented in female; in male left leg uniramose, 5-segmented, right leg biramose, exopod 3-segmented, endopod 1-segmented; surface (Adriatic).
♂ ♀ **Hypoacartia** Steuer, 1915

Fifth legs biramose in female, rami 1-segmented-------------------- 167

167. Fifth legs uniramose in male, right leg 4-segmented, left 3-segmented, without a chela; fifth endopods in the female reduced to spines; Antarctic plankton.
♂ ♀ **Paralabidocera** Wolfenden, 1908

Left fifth leg in male uniramose, 3-segmented; right leg biramose, exopod 2-segmented, endopod a claw; fifth endopods in female conical; surface (Gulf of Manaar)- ♂ ♀ **Acartiella** Sewell, 1914

168. Endopods of fifth legs 3-segmented in both sexes; exopods in female 3-segmented, middle segment with spine; left male exopod 2-segmented right 3-segmented; open ocean.
♂ ♀ **Centropages** Krøyer, 1849 (p. 85)[20]

Endopods of fifth legs 2-segmented in both sexes; exopods in female 3-segmented, middle segment with spine; left male exopod 1-segmented, right 3-segmented; fresh water (New Zealand)---------------------------- ♂ ♀ **Calamoecia** Brady, 1906

169. Caudal rami six times as long as wide; fifth legs 3-segmented in female; in male left fifth leg 4-segmented, right 3-segmented, uncinate; open ocean----- ♂ ♀ **Temora** Baird, 1850 (p. 103)

Caudal rami only three times as long as wide or less----------------- 170

170. Exopod of second antenna less than half as long as endopod---------- 171

Exopod of second antenna as long as the endopod------------------- 172

171. Fifth legs in female 3-segmented, each tipped with a long seta; in male 4-segmented and somewhat asymmetrical, the right leg the longer; open ocean----- ♂ ♀ **Acartia** Dana, 1846 (p. 159)

Fifth legs in female 2-segmented, basal segments fused, end segment a toothed claw; in male right leg 4-segmented, left 3-segmented, half as long as right; open ocean.
♂ ♀ **Paracartia** T. Scott, 1894

172. Urosome symmetrical; fifth legs in female 3- or 4-segmented, in male 4-segmented, the two distal segments of right leg forming a stout chela; open ocean-------- ♂ ♀ **Calanopia** Dana, 1852

Urosome asymmetrical; male fifth legs without a chela-------------- 173

173. Fifth legs in female 2- or 3-segmented, often unequal in length; in male 4-segmented with a terminal claw; right leg often only 3-segmented; open ocean- ♂ ♀ **Tortanus** Giesbrecht, 1898 (p. 166)

Fifth legs in female 3-segmented, very small and symmetrical; left leg in male 4-segmented, right 3-segmented, the 2 end segments scissorlike; open ocean-- ♂ ♀ **Candacia** Dana, 1846 (p. 138)

174. Fifth legs uniramose or lacking in female, biramose in male----------- 175

Fifth legs uniramose in both sexes, in female 4-segmented, in male 5-segmented, without a chela; exopod of second antenna made up of 7 segments; open ocean.
♂ ♀ **Eurytemora** Giesbrecht, 1881 (p. 107)

Fifth legs biramose in female, or in both sexes--------------------- 176

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[20] In exceptional cases fusion causes the endopods of one or all the swimming legs to appear 2-segmented.

175. Fifth legs lacking in female; in male both fifth legs biramose, endopods 1-segmented, right exopod 2-segmented, left exopod with 3 segments; open ocean__ ♂ ♀ **Valdiviella** Steuer, 1904

Fifth legs uniramose in female, 3-segmented; left leg in male biramose, exopod 3-segmented, endopod 1-segmented; right leg uniramose, 3-segmented; open ocean. ♂ ♀ **Undinella** G. O. Sars, 1900

176. Fifth legs biramose in both sexes; in female exopods 3-segmented, endopods 2-segmented; in male rami of right leg 2-segmented, of left 3-segmented; fresh water (Tasmania). ♂ ♀ **Brunella** G. W. Smith, 1909

Fifth legs biramose in female, rami 1-segmented, rudimentary; exopods of third and fourth legs 2-segmented; rostrum shaped like duck's bill; Antarctic plankton_ ♀ **Pseudoothrix** Brady, 1918

177. Fifth legs lacking in female; exopods of first 4 pairs of legs 2-segmented; first antenna 3-segmented; caudal rami 13 times as long as wide; open ocean___ ♀ **Mormonilla** Giesbrecht, 1891

Fifth legs lacking in female; both rami of first 4 pairs of legs 1-segmented, except fourth exopod, which is 2-segmented; caudal rami very short; Antarctic plankton. ♀ **Euchaetopsis** Brady, 1918

Fifth legs present in femle, uniramose and 4-segmented; basal segments of right and left legs in both sexes fused across the midline____ 178

Fifth legs present in female, uniramose and 2- or 3-segmented__________ 179

178. Fifth legs in male uniramose 4-segmented; second segment of left leg with curved inner process (endopod?); urosome symmetrical in both sexes; salt and brackish water. ♂ ♀ **Heterocope** G. O. Sars, 1863

Right leg in male 4-segmented, left 2-segmented, its end segment lamelliform with 2 opposable claws; male urosome with stout process on left side; fresh water. ♂ ♀ **Lamellipodia** Schmeil, 1897

179. Fifth legs in female 3-segmented, end segment sharply toothed; left fifth leg in male 3-segmented, right 2-segmented; male urosome distorted to the right; fresh water. ♂ ♀ **Epischura** Forbes, 1882 (p. 115)

Fifth legs in female 2-segmented, end segment with 2 short apical spines; male unknown; second endopod with deep excavation on inner margin; Antarctic plankton__ ♀ **Plagiopus** Brady, 1918

KEY TO THE GENERA OF THE SUBORDER HARPACTICOIDA

(Again the swimming legs, especially the fifth pair, furnish the best distinctive characters)

1. Endopod of fourth leg lacking or replaced by 1 or 2 setae______________ 2

Endopod of fourth leg made up of 1 segment_________________________ 4

Endopod of fourth leg made up of 2 segments________________________ 20

Endopod of fourth leg made up of 3 segments (see 10)________________ 74

2. Rami of first legs 2-segmented, endopod longer than exopod; second, third, and fourth exopods enlarged, with stout spines; exopod of second antenna 1-segmented; littoral, among algae ---------- ♂ ♀ **Platychelipus** Brady, 1880
   Rami of first legs 3-segmented, of second legs 2-segmented, of third and fourth legs entirely lacking; fifth legs 1-segmented; each caudal ramus with 1 apical spine; parasitic on octopus. ♀ **Cholidya** Farran, 1914
   Rami of first legs not segmented alike ---------- 3
3. Exopods of first legs 3-segmented, endopods 2-segmented; body segments with posterior spines; basipods not geniculate; third and fourth endopods lacking; in brackish pools -- ♀ **Nannopus** Brady, 1880
   Exopods of first legs 3-segmented, endopods 1-segmented; basipods all geniculate; 2 rows of dorsal spines; lateral spines on the head and first segment; muddy bottom, in algae. ♀ **Echinopsyllus** G. O. Sars, 1909
4. Endopods of second and third legs entirely lacking; second exopod 1-segmented, third exopod 2-segmented; fifth legs foliaceous, 2 segmented, reduced in the male; bottom plankton. ♂ ♀ **Laophontina** Norman and Scott, 1905
   Endopod of third legs 1-segmented, rudimentary ---------- 5
   Endopod of third legs with 2 or more segments ---------- 16
5. First legs natatory, with setae but without terminal claws ---------- 6
   First legs prehensile, armed with terminal claws ---------- 13
6. Endopods of first legs 2-segmented ---------- 7
   Endopods of first legs 1-segmented ---------- 11
7. Exopods of first legs 2-segmented, as long as endopods; 2 rows of latero-dorsal pectinate processes; fifth legs without a basal expansion; muddy bottom, 12 fathoms -- ♀ **Ceratonotus** G. O. Sars, 1909
   Exopods of first legs 3-segmented, the same length as the endopods; no pectinate processes; fifth legs with basal expansion bearing 4 setae; littoral, Banyuls ------ ♀ **Tryphoema** Monard, 1926
   Exopods of first legs 3-segmented, usually not same length as endopods ---------- 8
8. Endopods of first legs longer than exopods; second, third, and fourth endopods 1-segmented, with a single spine; segments of fifth legs fused, with 10 setae; littoral, 6 to 20 fathoms. ♂ ♀ **Pontopolites** T. Scott, 1894
   Endopods of first legs shorter than exopods ---------- 9
9. Exopods of third legs 2-segmented; fifth legs tipped with 3 spines and a spatulate process; exopod of second antenna 1-segmented, and very short; fresh water, shallows. ♀ **Parastenocaris** Kessler, 1913 (p. 289)
   Exopods of third legs 3-segmented; fifth legs with setae only ---------- 10
10. Endopods of second legs 2-segmented, of third and fourth legs 2- or 1-segmented; caudal rami widely separated; no legs modified in male; 2 ovisacs; muddy bottoms, 30 to 40 fathoms. ♂ ♀ **Eurycletodes** (part) G. O. Sars, 1909
    Endopods of second, third, and fourth legs in female 1-segmented, in male, second 1-segmented, third 2-segmented, fourth 3-segmented, the latter with a 3-barbed apical spine; brackish pools ---------- ♂ ♀ **Itunella** Brady, 1894

11. Exopods of first legs 1-segmented; basipods elongate, geniculate, projecting laterally beyond body margins; distal segment of fifth legs linear, 5 setae; muddy sand, 30 fathoms.
♂ ♀ **Anoplosoma** G. O. Sars, 1911

Exopods of first legs 3-segmented; basipods not geniculate................ 12

12. Spines on first legs short, stout, bluntly pointed; rostrum longer than basal segment of first antennae; caudal rami close together; tidal pools................ ♀ **Huntemannia** Poppe, 1885

Spines on first legs slender, elongate, acuminate; rostrum much shorter than basal segment of first antenna; caudal rami widely separated; moderate depths, mud.
♂ ♀ **Eurycletodes** (part) G. O. Sars, 1909

13. Both rami of first 4 pairs of legs 1-segmented, of equal length; fifth legs 1-segmented, each with 2 apical setae; exopod of second antennae 2-segmented; Antarctic plankton.
♀ **Microcryobius** Brady, 1910

Both rami of first legs 2-segmented, endopod longer than exopod; fifth legs 2-segmented, distal segment very small; exopod of second antenna 1-segmented; littoral in sand.
♂ ♀ **Paramesochra** T. Scott, 1892

Both rami of first legs 3-segmented, endopod longer than exopod.......... 14

Rami of first legs not segmented alike.................................. 15

14. Basipods and basal endopod segment of first legs elongated; second endopod 2-segmented, third and fourth endopods 1-segmented; segments of fifth legs fused, both sexes; on baleen of blue whale.......... ♂ ♀ **Balaenophilus** Aurivilius, 1879

Basipods and basal endopod segment of first legs short; second endopod segment elongated; a stout curved spine at each posterior corner of head; littoral (New Zealand).
♀ **Meropia**, new name for **Merope** [21]

15. Exopods of first legs 3-segmented, endopods 2-segmented, longer than exopods; each fifth leg a triangular lamella, with a stout spine and 7 setae; muddy bottom, shallow.
♀ **Evansula** T. Scott, 1906 (p. 254)

Exopods of first legs 1-segmented, of 3 following pairs 3-segmented; first endopods 2-segmented, others 1-segmented; fifth legs 2-segmented, basal expansion without setae; beach sands.......................... ♂ ♀ **Emertonia**, new genus (p. 256)

16. First legs prehensile, endopods much longer than exopods.............. 17

First legs natatory, armed only with plumose setae.................... 18

17. First endopods stout, with 1 strong apical claw; exopod of fourth legs 2-segmented; rostrum truncate, with apical fringe of cilia; fifth legs 2-segmented; muddy bottom, shallow.
♀ **Harrietella** T. Scott, 1906

First endopods slender, with 2 weak apical claws; exopod of fourth legs 3-segmented; rostrum pointed, not fringed; fifth legs 1-segmented, 2 spines, 5 setae; muddy bottom, shallow.............................. ♂ **Evansula** T. Scott, 1906 (p. 254)

18. Head fused with first segment, produced at its posterior corners into long, acuminate, notched spines; similar spines on sides of body; oyster washings (Ceylon).
♀ **Laophontella** Thompson and Scott, 1903

No spines at posterior corners of head or on the body................ 19

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[21] The name *Merope* Thomson had been preoccupied three times.

19. Distal segment of first endopod a little longer than proximal; distal segments of second and third endopods three times as long as the proximal; fresh water, brackish pools.
♂ ♀ **Marshia** Herrick, 1895 (p. 235)

Proximal segment of first endopod a little longer than distal; segments of second and third endopods about equal in length and very short; wet moss, woodlands (Bohemia)
♂ ♀ **Epactophanes** Mrázek, 1894

20. Endopods of second and third legs obsolete; exopod of first legs 2-segmented; fifth legs small, foliaceous, 2-segmented; first antennae stout, 8-segmented; muddy bottoms, shallow.
♀ **Leptopsyllus** T. Scott, 1894

Endopods of second and third legs 1-segmented; exopod of first legs 3-segmented; each fifth leg a 1-segmented oval lamella; first antennae slender, 6-segmented; muddy bottoms, shallow.
♀ **Stenocaris** G. O. Sars, 1909 (p. 286)

Endopods of second and third legs with 2 or 3 segments---------------- 21

21. Endopod of third legs made up of 3 segments------------------------ 22
Endopod of third legs made up of 2 segments------------------------ 29

22. Third, and often second, endopod modified for prehension, males--------- 23
Neither second nor third endopods modified for prehension, both sexes-- 27

23. Endopods of first legs 2-segmented, shorter than exopod, of second and fourth legs 2-segmented, unmodified, of third legs 3-segmented, modified for prehension; in a holothurian.
♂ **Abacola** C. L. Edwards, 1891

Both rami of first legs 1-segmented; exopods of second and third legs 2-segmented, endopods 3-segmented; exopod of fourth leg 3-, endopod 2- segmented; fifth legs lacking; littoral.
♂ **Syngastes** Monard, 1924

Endopods of first legs 2-segmented, much longer than exopods, very stout and tipped with a strong claw for prehension------------- 24

Endopods of first legs 2- or 3-segmented, as long as, or longer than, the exopods, but natatory, slender, and armed with plumose setae only-- 25

24. Caudal rami long and cylindrical, with setae as long as urosome, first exopods usually 3-segmented; third exopods often slightly modified; moderate depths, among algae.
♂ **Laophonte** Philippi, 1840 (p. 262)

Caudal rami short and lamellar, setae shorter than the rami; first exopods always 2-segmented; third endopods only modified, exopods normal; tide pools, among algae-- ♂ **Asellopsis** Brady, 1873

25. Both second and third endopods 3-segmented and modified for prehension; endopod of first legs 3-segmented; exopod of second antennae 2-segmented, 4 setae; on fresh-water plants.
♂ **Canthocamptus** Westwood, 1836 (p. 231)

Third endopod only modified, second endopod 2-segmented, unmodified; endopod of first legs 2-segmented; exopod of second antennae 1-segmented-- 26

26. Distal segment of fifth legs longer than wide, armed with 5 setae; inner expansion of basal segment much reduced, with only 2 setae; bottom forms, fresh water.
♂ **Attheyella** Brady, 1880 (p. 233)

Distal segment of fifth legs wider than long, armed with 4 setae; inner expansion of basal segment longer than distal segment, with 3 setae; fresh water (Peruvian Andes).
♂ **Godetella** Delachaux, 1918

27. Rami of first legs equal in length; endopod of second antennae 3-segmented, exopod 1-segmented; no rudiments of sixth legs present in male; fresh water, subterranean.
♂ ♀ **Viguierella** Maupas, 1906

Endopod of first legs shorter than exopod; endopod of second antenna 2-segmented, exopod 1-segmented; rudiments of sixth legs present in male; in meadow moss.
♂ ♀ **Phyllognathopus** Mrázek, 1894

Endopod of first legs longer than exopod; endopod and exopod of second antennae each made up of 2 segments---------------------- 28

28. Distal segment of fifth legs narrow-elongate, with 5 setae; inner expansion of basal segment well developed, with 6 or more setae; fresh water, among plants- ♀ **Canthocamptus** Westwood, 1836 (p. 231)

Distal segment of fifth legs broadly oval, with 6 setae; inner expansion of basal segment only moderately developed, with 4 setae or less; salt water, littoral---- ♀ **Pseudodiosaccus** T. Scott, 1906

29. Endopod of first legs made up of 3 segments---------------------------- 30

Endopod of first legs made up of 2 segments---------------------------- 39

Endopod of first legs 1-segmented, much reduced in size; exopod of second antennae lacking or replaced by a seta; second and third endopods 1-segmented; on decaying algae.
♀ **Eurycletodes** G. O. Sars, 1909

Endopod of first legs lacking, replaced by a dagger-shaped spine; of second and third legs 2-segmented; exopod of second antenna 1-segmented, with 4 setae; on seaweed in trawl net--------------------------- ♀ **Pseudocletodes** T. Scott, 1893

30. First antennae 5-segmented, distal segment much longer than the 2 preceding segments combined------------------------------ 31

First antennae 6- to 10-segmented, distal segment much shorter than the 2 preceding segments combined---------------------- 32

31. Rostrum triangular, with apical filaments; caudal rami longer than wide, their lateral margins naked, or with a few scattered hairs; shallow water (Norwegian coast).
♀ **Cletomesochra** G. O. Sars, 1920

Rostrum semielliptical, without filaments; caudal rami as wide as long, both lateral margins densely fringed with coarse hairs; shallow water (Scottish seas)-- ♀ **Heteropsyllus** T. Scott, 1894

32. Caudal rami long, narrow, and widely separated------------------------ 33

Caudal rami short, broad and close together---------------------------- 34

33. Rami of first 4 pairs of legs slender, elongate; fifth legs enlarged into enormous laminae, 2-segmented in female; in male small and 1-segmented; sandy bottom, 30 fathoms.
♂ ♀ **Pteropsyllus** T. Scott, 1906

Rami of first 4 pairs of legs much widened, especially the basal segments of endopods; fifth legs minute, 2-segmented, no basal expansion; muddy bottom, 30–100 fathoms.
♀ **Cervinia** Norman, 1878

34. First antennae 9- or 10-segmented; exopod of second antenna 4-segmented; rami of first legs about equal in length and natatory, with setae only; muddy bottom, 30–50 fathoms. ♀ **Neobradya** T. Scott, 1892

First antennae 8-segmented, more or less fused; exopod of second antennae 4-segmented; inner expansion of fifth legs reduced in both sexes; fresh water----- ♂ ♀ **Nitocrella** Chappuis, 1924

First antennae 8-segmented; exopod of second antenna 3-segmented, or less-- 35

First antennae 6- or 7-segmented; exopod of second antenna 1-segmented-- 37

35. Inner expansion of basal segment of fifth legs wholly lacking, distal segment, linear, five times as long as wide, 3 apical and 1 inner setae; pelagic, 100 fathoms-------- ♀ **Eremopus** Brady, 1910

Inner expansion of fifth legs well developed, distal segment shorter-- 36

36. Inner expansion of fifth legs wider than distal segment, with 6 setae; distal segment twice as long as wide; 2 apical, 2 outer, 1 inner setae; fresh water, among plants- ♀ **Attheyella** Brady, 1880 (p. 233)

Inner expansion of fifth legs a wide lamina, with 1 seta; distal segment as wide as long, with 4 setae; exopod of second antenna 2-segmented; pelagic (Antarctic)-- ♀ **Mawsonella** Brady, 1918

37. Rami of first legs equal, endopod natatory; inner expansion of fifth legs as wide as long, no longer than end segment, 4 setae, 2 spines (Suez Canal)------------ ♀ **Pseudomesochra** Gurney, 1927[22]

Endopod of first legs much longer than exopod; inner expansion of fifth legs much longer than wide, and longer than end segment----- 38

38. Exopod of second antenna with 2 equal apical setae; inner expansion of fifth legs in male with 1 seta, 2 spines; end segment with 3 setae; brackish water------- ♂ ♀ **Apsteinia** Schmeil, 1894

Exopod of second antenna with 3 unequal apical setae; inner expansion of fifth legs in male with 2 or 3 subequal setae; end segment with 5 setae; brackish water- ♂ ♀ **Mesochra** Boeck, 1865 (p. 237)

39. Second segment of first antenna with large spine on outer margin--------- 40

Second segment of first antenna with setae only, no spine-------------- 41

40. Fifth legs huge unsegmented laminae, covering the eggs; each caudal ramus with inner laminate process; apical seta enlarged at base; muddy bottom, littoral. ♂ ♀ **Phyllopodopsyllus** T. Scott, 1906

Fifth legs normal, the 2 segments fused in female, separated in male; caudal rami without inner processes, apical setae not enlarged; muddy bottom, littoral------ ♂ ♀ **Orthopsyllus** Brady, 1873

41. Each fifth leg made up of basal segment only, end segment obsolete-- 42

Both segments of fifth legs present, but completely fused-------------- 45

Each fifth leg made up of 2 distinct segments, normally arranged--------- 49

42. Rami of first legs subequal in length; body extremely elongate---------- 43

Rami of first legs unequal in length; body moderately elongate--------- 44

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[22] Name preoccupied by T. Scott in 1902; changed in MS. by Guerney to *Nannomesochra.*

43. Fifth leg quadrangular, tipped with 8 unequal setae in female, 6 in male; second exopod in male with huge apical falciform claw; muddy sand, 20 fathoms----- ♂ ♀ **Cylindropsyllus** Brady, 1880

Fifth leg with 3 unequal apical setae; a fourth seta attached to outer process near the base; distal half of caudal rami abruptly narrowed (Norwegian coast)- ♀ **D'Arcythompsonia** T. Scott, 1906 (p 291)

44. Endopod of first leg definitely longer than exopod; fifth leg triangular, with a stout apical spine, 3 inner setae and 1 outer; sandy bottom, 30 fathoms-- ♀ **Leptastacus** T. Scott, 1906 (p. 252)

Exopod of first leg longer than endopod; fifth leg with 2 large outer spines and 6 setae in female, with 6 setae only in the male; littoral, 20 fathoms----- ♂ ♀ **Stenocaris** G. O. Sars, 1909 (p. 286)

Exopod of first leg longer than endopod; fifth leg with 2 apical setae in female, 4 in male; second and third endopods modified in male; brackish water, among algae--- ♂ ♀ **Horsiella** Gurney, 1920

45. Basipods of swimming legs geniculate, projecting laterally; body segments separated by conspicuous constrictions, often angular; littoral, among algae-------- ♂ **Laophontodes** T. Scott, 1894

Basipods of swimming legs neither geniculate nor projecting; body segments not separated by conspicuous constrictions----------- 46

46. Exopod of second antenna replaced by a seta; both third and fourth endopods modified for prehension in male, and both 2-segmented; fresh water (Germany)- ♂ ♀ **Wolterstorffia** Schmeil, 1894

Exopod of second antenna 1-segmented and tipped with setae; fourth endopods not modified in male------------------------------ 47

47. Setae of second legs elongated, naked, branched at tips; setae of fifth legs greatly enlarged basally in female, but not in male; beach sands--------------- ♂ ♀ **Quintanus**, new genus (p. 258)

Setae of second and fifth legs normal, neither branched at tips nor enlarged at base; third endopod modified in male--------------- 48

48. Endopod of second legs reaching distal end of second segment of exopod, with 1 long apical plumose seta, 2 inner, 1 outer naked setae (lakes in Peruvian Andes)- ♂ ♀ **Godetella** Delachaux, 1918

Endopod of second legs scarcely reaching proximal end of second segment of exopod, with 2 short, equal apical and 1 outer setae, all 3 plumose; fresh or brackish water. ♂ ♀ **Cletocamptus** Schmankevitsch, 1875

49. Basipods of swimming legs geniculate, projecting beyond the lateral margins of the body; fifth legs long and narrow-------------- 50

Basipods of swimming legs not geniculate nor projecting laterally; fifth legs variously shaped----------------------------------- 52

50. Rami of first legs subequal; body with a row of uniform, sharply pointed lappets on each side, 1 on each segment except last 2; muddy bottom, shallow-------- ♂ ♀ **Arthropsyllus** G. O. Sars, 1909

First endopod much longer than exopod; body without lappets; segments of second and third endopods often indistinct-- ------------- 51

51. Body segments with rounded lateral lobes, but no spines; first endopod with stout, curved, spinelike claw and 1 seta at the tip; littoral, shallow----------------- ♀ **Laophontodes** T. Scott, 1894

Body segments, except last 2, with curved, often branched, denticulate spines in 6 rows, lateral and dorsal; first endopod with 3 apical setae; muddy bottom--- ♀ **Ancorabolus** Norman, 1903

Neither lateral lobes nor spines; first endopod with 4 apical setae; end segment of fifth leg 10 times as long as wide, narrowed distally; muddy bottom--- ♂ ♀ **Malacopsyllus** G. O. Sars, 1911

52. Exopods of first legs 1-segmented, of second, third, and fourth legs 3-segmented; body and appendages hairy; end segment of fifth leg five times as long as wide; littoral (Bahama Islands).
♀ **Esola** C. L. Edwards, 1891

Exopods of first legs made up of 2 segments------------------------- 53

Exopods of first legs made up of 3 segments------------------------- 58

53. First legs prehensile, one or both rami tipped with claws-------------- 54

First legs natatory, both rami tipped with plumose setae--------------- 57

54. Second leg uniramose, 2-segmented; a stout, recurved claw on outer margin of second segment of first antenna; fifth leg 2-segmented, end segment with 3 setae; sandy bottom, shallow------------------------- ♀ **Pseudolaophonte** A. Scott, 1896

Second leg biramose; no claw on second antennal segment------------- 55

55. Body depressed, each segment with large lateral lamellae; caudal rami lamellar, with rudimentary setae; exopod of second antenna 1-segmented; littoral, often in tide pools.
♀ **Asellopsis** Brady, 1873

Body cylindrical, not depressed, without lateral lamellae; caudal rami also cylindrical, with well-developed setae--------------- 56

56. Posterior corners of head produced into spines; basal segment of first antenna elongate, with a spine at its inner distal corner; sandy bottom, shallow------ ♀ **Paramesochra** T. Scott, 1892

No spines at posterior corners of head, or on inner margin of basal antennal segment, but sometimes on outer margin of second segment; littoral, among algae.
♀ **Laophonte** Philippi, 1840 (p. 262)

57. Body cylindrical; first antenna 8-segmented; second antenna with 3-segmented endopod and 2-segmented exopod; end segment of fifth leg with 3 apical spines; wet moss in forest.
♂ ♀ **Maraenobiotus** Mrázek, 1894

Body cylindrical; first antennae 4-segmented; second antennae with 2-segmented endopod and 1-segmented exopod; end segment of fifth legs with 4 setae; muddy bottoms.
♀ **Sarsocletodes** Wilson, 1924[23]

58. Exopod of second antennae lacking or replaced by a seta--------------- 59

Exopod of second antennae made up of a single segment--------------- 60

Exopod of second antennae made up of 2 segments-------------------- 73

Exopod of second antennae 3-segmented, endopod also 3-segmented; end segment of fifth legs 3-lobed, each lobe with a seta; basal expansion with 4 setae; sifted from dredgings.
♀ **Pseudozosime** T. Scott, 1912

59. Endopod of first leg twice as long as exopod; end segment of fifth leg as wide as long, with 3 apical setae; first antennae 7-segmented; littoral, moderate depths--- ♀ **Leptopontia** T. Scott, 1902

Exopod of first leg longer than endopod; end segment of fifth leg four times as long as wide, with 5 setae; first antennae 5-segmented; muddy bottom, shallow--------- ♀ **Cletodes** Brady, 1872

Rami of first leg equal or subequal; end segment of fifth leg twice as long as wide, with 5 setae; first antennae 6-segmented; muddy bottoms--------- ♂ ♀ **Eurycletodes** (pars) Sars, 1909

60. First legs prehensile, one or both rami tipped with spines--------------- 61

First legs natatory, both rami tipped with plumose setae--------------- 66

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[23] A name to replace Sars's *Pseudocletodes*, which had been preoccupied.

61. Basal segment of first antenna nearly as long as remaining segments combined, a stout spine at its outer corner; endopod of second antenna 3-segmented; muddy bottom, shallow. ♂ ♀ **Tetragoniceps** Brady, 1880

Basal segment of first antenna short and without a spine ---------------- 62

62. Terminal segment of fifth leg two to four times as long as wide ---------- 63

Terminal segment of fifth leg nearly as wide as long, or wider ------------ 64

63. Caudal rami lamellar, twice the length of the anal segment, three times as long as wide, closely juxtaposed; apical setae short and rudimentary; muddy bottom, shallow. ♀ **Laophontopsis** G. O. Sars, 1908

Caudal rami cylindrical, no longer than anal segment, twice as long as wide, widely separated; apical setae long, stout, and well developed; moderate depths, among algae. ♀ **Normanella** Brady, 1880

64. Proximal segment of second antenna distinctly divided, the exopod attached to the end of the basal portion; fifth legs small, wider than long; littoral -------------- ♀ **Leptocaris** T. Scott, 1899

Proximal segment of second antenna divided, exopod attached to end of distal portion; fifth legs as long as wide; oyster washings -------------------- ♀ **Ceyloniella** Thompson and Scott, 1903

Proximal segment of second antenna not divided, the exopod attached to its outer margin --- 65

65. Endopod of first legs longer than exopod; caudal rami as wide as long and widely separated; segments of fifth leg separated in male; brackish pools, ditches ----- ♂ ♀ **Mesochra** Boeck, 1865 (p. 237)

Exopod of first legs longer than endopod; caudal rami longer than wide and close together; segments of fifth leg fused in the male; littoral, surface tow ------------ ♂ ♀ **Lourinia** Wilson, 1924

66. Terminal segment of fifth legs two to eight time as long as wide --------- 67

Terminal segment of fifth legs as wide as long or wider ------------------ 70

67. Exopods of first legs longer than endopods; distal endopod segment longer than proximal; caudal rami five times as long as wide, with 6 setae; muddy bottom --- ♀ **Mesocletodes** G. O. Sars, 1909

Exopods of first legs longer than endopods; distal endopod segment longer than proximal; caudal rami as wide as long, each with 2 setae; marine, Banyuls ----- ♀ **Nannopodella** Monard, 1928

Rami of first legs subequal; endopod segments in first 3 pairs of legs also about equal; caudal rami as wide as long, with 1 spine and 4 setae; beach sands ---- ♀ **Paraleptastacus**, new genus (p. 248)

Rami of first legs subequal; distal endopod segments in first 3 pairs of legs twice as long as proximal -------------------------------- 68

68. Rami of second and third legs subequal; first antennae 5-segmented in female, 7-segmented in male: exopod of second antenna with 1 apical and 1 lateral seta; muddy bottom, shallow ------------------------------ ♂ ♀ **Enhydrosoma** Boeck, 1872

Exopod of second and third legs much longer than endopod ----------- 69

69. End segment of fifth legs linear, eight times as long as wide, with 2 unequal apical, and 2 outer setae; basal expansion with but 1 seta; muddy bottom------ ♀ **Leptocletodes** G. O. Sars, 1920

End segment of fifth legs stout, twice as long as wide, with 2 equal apical, 1 outer, and 1 inner setae; basal expansion with 5 setae; stomach of shad---------------------- ♀ **Leimia** Willey, 1923

End segment of fifth legs three times as long as wide, with 2 unequal apical setae; basal expansion elongate, with 1 apical and 3 inner setae; fresh water (Amu River).
♂ ♀ **Limnocletodes** Borutzky, 1926

70. Exopod of first legs definitely longer than endopod-------------------- 71

Rami of first legs subequal, third leg modified in male----------------- 72

Rami of first legs subequal; none of the legs modified in male; endopod segments of first 4 pairs of legs subequal in length; beach sands------------------ ♂ **Paraleptastacus**, new genus (p. 248)

71. Segments of second, third, and fourth endopods subequal; basal expansions of fifth legs not reaching the midline, each with 4 very unequal setae; muddy bottom- ♀ **Hemimesochra** G. O. Sars, 1920

Distal segments of second, third, and fourth endopods two to four times as long as proximal; basal expansions of fifth legs fused, each with 5 setae; muddy bottom---- ♀ **Rhizothrix** Brady, 1875

72. Segments of second, third, and fourth endopods subequal, tipped with short and very weak setae; fifth legs small and armed with very short setae; shallow lakes, fresh water.
♂ ♀ **Moraria** T. Scott, 1893

Distal segments of second, third, and fourth endopods longer than proximal, with long, slender setae; fifth legs large and armed with long setae; shallow lakes, fresh water.
♂ ♀ **Attheyella** Brady, 1880 (p. 233)

73. Rostrum large and broad; metasome twice as wide as urosome, with epimeral plates; basal segment of first endopod wider than distal; muddy bottom, shallow-- ♀ **Stenheliopsis** G. O. Sars, 1906

Rostrum small and narrow; metasome passing insensibly into urosome, without epimeral plates; segments of first endopod of equal width; muddy bottom, shallow.
♀ **Pseudomesochra** T. Scott, 1902

74. Each ramus of first legs with but a single segment--------------------- 75

Each ramus of first legs with 2 or 3 segments------------------------- 76

75. Exopods of second and third legs 3-segmented; exopod of second antennae 2-segmented, tipped with 4 unequal setae; first antennae made up of 8 segments; littoral, sandy bottom.
♂ ♀ **Tegastes** Norman, 1903

Exopods of second and third legs 2-segmented; exopod of second antenna 1-segmented tipped with 2 equal setae; first antennae made up of 6 or 7 segments; littoral, sandy bottom.
♂ ♀ **Parategastes** G. O. Sars, 1904 (p. 194)

76. Endopod of first legs made up of 2 segments------------------------- 77

Endopod of first legs made up of 3 segments------------------------- 121

77. Exopod of first legs made up of 2 segments, rarely of 1 segment--------- 78

Exopod of first legs made up of 3 segments------------------------- 83

78. First legs natatory, with setae, endopod segments in male at right angles to each other; segments of fifth legs fused into a broad lamina; pelagic, surface tow------ ♂ ♀ **Euterpina** Norman, 1903

First legs prehensile, one or both rami armed with claws; fifth legs of usual pattern, with 2 distinct segments---------------------- 79

79. Exopod of first legs shorter than endopod, rarely 1-segmented---------- 80

Exopod of first legs longer than endopod, always 2-segmented---------- 81

80. Exopod of second antenna 2-segmented; exopod of first legs 2-segmented; basal expansion of fifth legs as long as end segment, with spinelike setae; littoral, tide pools.
♂ ♀ **Pseudothalestris** Brady, 1883 (p. 210)

Exopod of second antenna 3-segmented; exopod of first legs 1-segmented; end segment of fifth legs longer than basal expansion, with plumose setae; littoral, shallow water.
♂ ♀ **Parawestwoodia** Sharpe, 1910

81. Body strongly depressed, most segments with lateral lamellae------------ 82

Body cylindrical, without lamellae; metasome passing insensibly into urosome; spines on second antennae and legs not pectinated (Antarctic Ocean)------------- ♀ **Perissocope** Brady, 1910

82. Fifth segment abruptly narrowed, without lateral plates; spines on second antennae and legs pectinated; exopod of second antenna 2-segmented, 6 setae; littoral, in algae.
♂ ♀ **Zaus** Goodsir, 1845 (p. 190)

Fifth segment as wide as fourth, with lateral plates; spines on second antennae and legs not pectinated; exopod of second antenna 1-segmented, with 2 setae; beach sands.
♂ ♀ **Zausodes**, new genus (p. 187)

83. One or both rami of first legs conspicuously broadened or modified--- 84

Neither ramus of first legs much broadened or specially modified--------- 96

84. Fifth legs composed of a single segment------------------------------- 85

Fifth legs of the usual form, 2 distinct segments---------------------- 88

85. Endopod of first legs broadened, exopod normal, both natatory; central body segments produced laterally into long sickle-shaped lamellae; possibly parasitic.
♀ **Megarthrum** Norman and Scott, 1906

First legs only slightly broadened, but considerably modified for prehension; central body segments without lateral lamellae---------- 86

86. Body much swollen anteriorly, narrowed posteriorly; first antennae 5- or 6-segmented, with process on second segment; exopod of second antenna lacking-------------------------------- 87

Body elongate, nearly the same diameter throughout; first antennae 8-segmented, no process on second segment; exopod of second antenna 1-segmented, 3 setae; parasitic on land crabs---------------------------------- ♂ **Cancrincola** Wilson, 1913

87. Second antennae straight, not enlarged at tip; segments of fifth legs fully fused, end segment with 4, basal segment with 3, plumose setae; in a holothurian------ ♀ **Abacola** C. L. Edwards, 1891

End segment of second antenna turned at right angles and enlarged at tip; segments of fifth legs fused, each with 1 or 2 small spinules; littoral, among algae- ♂ ♀ **Metis** Philippi, 1843 (p. 305)

88. Exopod of second antenna made up of a single segment ---------- 89

Exopod of second antenna made up of 2 segments ---------- 91

Exopod of second antenna made up of 3 segments ---------- 93

89. Neither ramus of first legs broadened, endopod tipped with stout claw, hooked at the tip; basal expansion of fifth leg large, with 4 setae; parasitic on land crabs -- ♀ **Cancrincola** Wilson, 1913

One or both rami of first legs much broadened ---------- 90

90. Both rami of first legs broadened; caudal rami lamellate, with weak setae; fifth legs without basal expansion, end segment lanceolate; littoral, among algae ------- ♂ ♀ **Porcellidium** Claus, 1860

First endopod broadened, exopod normal; caudal rami cylindrical, with well developed setae; fifth legs with large basal expansion; littoral, among algae ---------- ♂ ♀ **Ialysus** Brian, 1927

91. Body strongly depressed, all but last 2 segments with lateral lamellae; first exopod longer than the endopod ---------- 92

Body strongly depressed, metasome and genital segments with angular lamellae; first endopod much longer than exopod, broadened; muddy bottom, fiords ---------- ♀ **Idyella** G. O. Sars, 1905

Body little depressed, second, third, and fourth segments only with lamellae; rami of first legs equal, both widened; fifth legs long and narrow; brackish pools, in algae.
♂ ♀ **Chappaquiddicka**, new genus (p. 198)

92. Every body segment with anastomosing chitin bands and dorsal projections on midline; corners of genital segment reaching caudal rami; littoral, sandy bottom ----- ♂ ♀ **Peltidium** Philippi, 1839

Body segments without chitin bands or dorsal projections; corners of genital segment scarcely reaching basal abdominal segment; washed from dredgings ------ ♀ **Eupeltidium** A. Scott, 1909

93. Proximal segment of first endopod longer than entire exopod; rostrum not visible dorsally ---------- 94

Proximal segment of first endopod much shorter than exopod; rostrum large and conspicuous in dorsal view ---------- 95

94. Fifth segment but little narrower than fourth; caudal setae very short; basal segment of fifth legs without outer process; first antenna 7-segmented; littoral (New Zealand).
♂ ♀ **Xouthous** Thomson, 1883

Fifth segment abruptly narrowed to half the width of fourth; caudal setae long; fifth legs with large outer process; first antenna with 9 segments; littoral (Kerguelen Island).
♀ **Machairopus** Brady, 1883

95. Distal segment of first endopod half as long as basal, with 2 unequal terminal spines; metasome more than twice as wide as urosome; muddy bottom ------ ♀ **Dactylopodopsis** G. O. Sars, 1911

Distal segment of first endopod twice as long as basal, with 3 apical setae; metasome little wider than urosome; second leg modified in male; muddy bottom ------ ♂ ♀ **Danielssenia** Boeck, 1873

96. Fifth legs made up of from 2 to 4 segments ---------- 97
Fifth legs made up of a single segment ---------- 119
Fifth legs obsolete or represented by a seta ---------- 120
Fifth legs unknown; first antennae 9-segmented, laminate, without a sensory filament; second endopod 3-segmented, armed with spines and plumose setae; pelagic (Antarctic Ocean) ---------- ♀ **Dactylopina** Brady, 1910
Fifth legs unknown; first antennae 10-segmented, cylindrical, with a sensory filament; second endopod 1-segmented, armed with setae, no spines; littoral (New Zealand). ♀ **Flavia** Brady, 1899

97. Fifth legs made up of 4 segments, males ---------- 98
Fifth legs made up of 3 segments, males ---------- 99
Fifth legs made up of 2 segments, both sexes ---------- 100

98. Middle segment of first exopod much the longest; third endopod modified for prehension; exopod of second antennae 2-segmented, armed with 6 setae; littoral, among algae. ♂ **Microthalestris** G. O. Sars, 1905 (p. 204)
The 3 segments of first exopod subequal; third endopod not modified for prehension; exopod of second antenna 3-segmented and armed with 5 setae; oyster washings (Ceylon). ♂ **Parastenhelia** Thompson and Scott, 1903

99. First legs prehensile; second basipod longer than the 2-segmented endopod; middle exopod segment longer than the first and third segments combined; littoral, shallow water. ♂ **Eupelte** Claus, 1860
First legs natatory; second basipod not lengthened; the 3 exopod segments about the same length; caudal rami very long and narrow; muddy bottom, shallow ---------- ♂ **Herdmania** Thompson, 1893

100. Fifth legs linear, basal segment without inner expansion ---------- 101
Fifth legs stout, basal segment with inner expansion ---------- 105

101. Body depressed; metasome and genital segments with lamellae and dorsal projections; first endopods widened, shorter than exopods; littoral, sandy bottom ---------- ♂ ♀ **Peltidium** Philippi, 1839
Body depressed; metasome and genital segments with lamellae without projections; both rami of first legs widened, exopods the shorter; muddy bottom, shallow ---------- ♀ **Idyella** G. O. Sars, 1905
Body depressed; metasome and genital segments with lamellae, without projections; neither ramus of first legs widened ---------- 102
Body cylindrical, without lamellae or projections ---------- 103

102. Rami of first legs subequal; middle segment of first exopod three times as long as end segment, the latter natatory, with setae; dredge washings ---------- ♂ ♀ **Paralteutha** T. Scott, 1912
First exopod more than twice as long as endopod, its middle segment five times as long as end segment, the latter prehensile, with claws; littoral, muddy bottom ---------- ♀ **Eupelte** Claus, 1860

103. Caudal rami 15 times as long as wide; the 3 segments of first exopod about the same length; first legs natatory, with setae; muddy bottom, shallow ---------- ♀ **Herdmania** Thompson, 1893
Caudal rami as wide as long; end segment of first exopod shorter than either of the 2 other segments ---------- 104

104. First exopod much longer than endopod; exopod of second antennae 1-segmented; basal segments of fifth legs reaching midline, not expanded; littoral---------------- ♀ **Fultonia** T. Scott, 1902
First endopod a little longer than exopod; exopod of second antennae 4-segmented; basal segments of fifth legs narrow, not reaching midline; littoral, among algae-- ♀ **Tisbella** Gurney, 1927

105. The 2 segments of fifth legs completely fused------------------------- 106
The 2 segments of fifth legs distinctly separated----------------------- 107

106. Caudal setae as long as the body; second endopod considerably longer than exopod; all the legs tipped with very long plumose setae; sandy mud, shallow------ ♀ **Psammis** G. O. Sars, 1910
Caudal setae half as long as body, or less; second endopod much shorter than exopod; all exopod setae with plumes at their tips; littoral, muddy bottom-- ♀ **Sigmatidium** Giesbrecht, 1881

107. Exopod of second antenna made up of 3 distinct segments----------- 108
Exopod of second antenna made up of 2 distinct segments----------- 112
Exopod of second antenna made up of a single segment-------------- 115
Exopod of second antenna entirely lacking; basal expansion of fifth legs with 4 setae in female, 2 in male; end segment linear, 6 setae; pelagic------ ♂ ♀ **Macrosetella** A. Scott, 1909 (p. 281)

108. Endopod of second antenna 3-segmented, with a distinct basipod to whose outer distal corner the exopod is attached-------- 109
Endopod of second antenna 2-segmented, without a basipod, exopod attached to side of proximal endopod segment------------ 110

109. Rami of first legs natatory and subequal in length; distal segment of fifth legs as wide as long, with 4 setae; rostrum short and blunt, muddy bottom, shallow---- ♂ ♀ **Zosime** Boeck, 1872
Rami of first legs prehensile, endopod much longer than exopod; distal segment of fifth legs three times as long as wide, with 6 setae; oyster washings (Ceylon).
♂ ♀ **Parastenhelia** Thompson and Scott, 1903

110. Rostrum entirely lacking; end segment of fifth leg projecting laterally, the same width throughout, 3-lobed at tip, each lobe with 1 seta; littoral, in algae------ ♀ **Halophytophilus** Brian, 1918
Rostrum present and well developed; distal segment of fifth leg not the same width throughout---------------------------------- 111

111. Rostrum notched near tip on either side; distal segment of fifth leg narrowed at base, widest at tip, longer than basal expansion; muddy bottom------- ♂ ♀ **Stenhelia** Boeck, 1864 (p. 228)
Rostrum smoothly rounded, no notches; distal segment of fifth leg widest at base, narrowed at tip, shorter than basal expansion; brackish mouths of rivers-- ♂ ♀ **Danielssenia** Boeck, 1873

112. Endopod of second antenna 3-segmented; endopods of second and third legs 2-segmented; body very long, narrow, and of uniform width throughout; sandy bottom, shallow.
♂ ♀ **Leptomesochra** (part) G. O. Sars, 1911
Endopod of second antenna 3-segmented; endopods of second and third legs 3-segmented; body not of uniform width but apparently 3-parted; littoral (Mediterranean).
♀ **Peltthestris** Monard, 1924
Endopod of second antenna 2-segmented; endopods of second and third legs 3-segmented, 2 distal segments of second legs sometimes fused--- 113

113. Rami of first legs narrow cylindrical; middle segment of first exopod but little longer than wide; urosome fully as wide as metasome; moderate depths------- ♂ ♀ **Schizopera** G. O. Sars, 1905

Rami of first legs broadened into laminae; middle segment of first exopod little longer than wide; metasome twice as wide as urosome; moderate depths, among algae. ♂ ♀ **Dactylopodella** G. O. Sars, 1906

Rami of first legs of normal width; middle segment of first exopod much longer than wide; second endopod always 3-segmented--- 114

114. Middle segment of first exopod twice as long as wide; metasome much wider than urosome; end segment of fifth legs ovate, with 6 setules; washed from dredgings. ♀ **Eudactylopus** A. Scott, 1909

Middle segment of first exopod four to six times as long as wide; urosome nearly as wide as metasome; end segment of fifth legs tetragonal, 8 setae; littoral, among algae. ♂ ♀ **Microthalestris** G. O. Sars, 1905 (p. 204)

115. Stout anterior spines on second segment of first antenna; 1 or 2 apical caudal setae enlarged at base; fourth legs tipped with setae only; littoral, among algae-- ♂ ♀ **Bradyellopsis** Brian, 1924

No spines on second segment of first antennae; outer caudal setae transformed into acuminate stylets; fourth leg with a stylet and a seta; beach sands---- ♂ ♀ **Goffinella**, new genus (p. 260)

No spines on first antennae; caudal setae not enlarged or modified-- 116

116. Endopods of second and third legs 2-segmented, of fourth legs 3-segmented; forehead without lenses; sandy bottom, shallow water-------------------- ♂ ♀ **Leptomesochra** G. O. Sars, 1911

Endopods of second legs 2-segmented, of third and fourth legs 3-segmented; forehead with 2 conspicuous lenses; pelagic, at surface------------------------------- ♂ ♀ **Miracia** Dana, 1846 (p. 284)

Endopods of second, third, and fourth legs 3-segmented-------------- 117

117. Exopods fringed with stout spinules; apical setae exceptionally long; rami of first legs subequal; fifth legs large, with stout setae; littoral, among algae------- ♂ ♀ **Psyllocamptus** T. Scott, 1899

Exopods fringed with hairs, no spinules; apical setae of normal length; rami of first legs unequal----------------------------- 118

118. First antenna 4-segmented; fifth legs diminutive, with weak setae; rows of small spinules across ventral surface of the abdominal segments; littoral--------- ♂ **Sigmatidium** Giesbrecht, 1881

First antenna 8-segmented; fifth legs large and broad, with enlarged setae; no spinules across ventral surface of abdominal segments; pelagic, surface tow- ♀ **Tydemanella** A. Scott, 1909

First antennae 9-segmented; fifth legs very large and broad, with minute setae; second endopod 2-segmented in male; no ventral spinules on the abdomen; muddy bottoms. ♂ ♀ **Plesiothalestris** Brian, 1928

119. First exopod 3-segmented, prehensile, endopod 2-segmented, natatory; each fifth leg 1 spiniform segment, with short apical claw and 6 lateral setae; pelagic, surface tow.
♀ **Parapeltidium** A. Scott, 1909

First exopod 3-segmented, endopod 2-segmented, both natatory; each fifth leg a rounded lamina, wider than long, with 6 marginal setae, but no claw; muddy bottom, shallow water.
♂ ♀ **Stenheliopsis** G. O. Sars, 1906

First exopod 3-segmented, endopod 2-segmented, both prehensile; each fifth leg a transverse plate, with 4 setae; rudiments of sixth legs present; muddy bottom, shallow water.
♂ **Stenhelia** Boeck, 1864 (p. 228)

120. Exopod of second antenna 1-segmented; terminal claw of second maxilla large and stout; fifth legs obsolete, each replaced by 2 or 3 small setae; pelagic, 50 fathoms.
♀ **Metaphroso** Brady, 1910

Exopod of second antenna 2-segmented; terminal claw of second maxilla weak; each fifth leg replaced by a minute pointed tubercle without setae; muddy bottom, shallow water ---------------------------------- ♀ **Campella** Wilson, 1924

121. Exopod of first legs with 1 or 2 segments --------------------------- 122
Exopod of first legs always with 3 segments --------------------------- 126

122. Exopods of first legs definitely longer than endopods ---------------- 123
Endopods of first legs definitely longer than exopods ---------------- 124

123. Body not depressed; no lateral epimeral plates; second endopod and third exopod modified in male; no ciliated spines on appendages; littoral, among algae.
♂ ♀ **Harpacticus** Milne Edwards, 1838 (p. 181)

Body strongly depressed; metasome and urosome with lateral epimeral plates; ciliated spines on second antennae and swimming legs; littoral, among algae -- ♂ ♀ **Zaus** Goodsir, 1845 (p. 190)

124. Basal segment of first endopod longer than 2 distal segments combined --- 125

Basal segment of first endopod much shorter; first exopod 1-segmented; end segment of fifth legs four to eight times as long as wide, with 5 setae; pelagic, surface tow.
♂ ♀ **Clytemnestra** Dana, 1847 (p. 292)

125. Basal segment of first endopod much widened and flattened; distal segment with 2 apical spines; end segment, fifth leg, shorter than basal expansion; littoral, tide pools.
♂ **Pseudothalestris** Brady, 1883 (p. 210)

Basal segment of first endopod not widened or flattened; distal segment with 1 apical spine; end segment, fifth leg, longer than basal expansion; littoral, among algae.
♀ **Diarthrodes** Thomson, 1883

126. Fifth legs made up of 3 segments---------------------------------- 127

Fifth legs made up of 2 segments, of the usual form----------------- 128

Fifth legs made up of 2 segments but falciform; basal segment without inner expansion and outer process; body usually depressed; littoral, among algae--- ♂ ♀ **Alteutha** Baird, 1845 (p. 192)

Fifth legs made up of 2 segments but completely fused; anal operculum finely ciliated; segments of first endopod equal; caudal rami as long as anal segment; fresh water, Serbia.
♀ **Ceuthonectes** Chappuis, 1924

Fifth legs made up of a single segment, often rudimentary----------- 174

Fifth legs entirely lacking; rami of first 4 pairs of legs 3-segmented; second antennae 2-segmented, exopod obsolete; first antennae 8-segmented; littoral, muddy bottom.
♀ **Aenippe** Philippi, 1843

127. First antenna 10-segmented; head with 6 long pectinated spines; both rami of the second antennae 4-segmented; caudal setae longer than body; pelagic, 2,200 fathoms.
♀ **Pontostratiotes** Brady, 1883

First antennae 16-segmented; head without spines; endopod of second antennae 4-segmented, exopod 6-segmented; caudal setae half as long as body; littoral, muddy bottom.
♂ ♀ **Misophria** Boeck, 1864

128. Terminal segment of fifth legs 3-lobed, each lobe with a large plumose seta, basal expansion with 2 similar setae----------------- 129

Terminal segment of fifth legs not 3-lobed, basal expansion usually with more than 2 setae------------------------------------ 131

129. Rostral plate very small; exopod of second antenna attached to basal segment of endopod; anal abdominal segment with 2 stout dorsal claws; beach sands- ♂ ♀ **Arenosetella**, new genus (p. 178)

Rostral plate very large; exopod of second antenna attached to side of second endopod segment; anal abdominal segment without dorsal claws; littoral, muddy bottom.
♀ **Ectinosomella** G. O. Sars, 1911

Rostral plate medium, but conspicuous; exopod of second antenna attached to basal endopod segment; anal segment without claws--- 130

130. Terminal segment of fifth leg as wide as long; caudal rami usually shorter than anal segment; exopod of second antenna always 3-segmented; muddy bottom, shallow.
♂ ♀ **Ectinosoma** Boeck, 1864 (p. 173)

Terminal segment of fifth leg much longer than wide; caudal rami longer than anal segment; exopod of second antenna often 2-segmented; muddy sand, shallow.
♂ ♀ **Pseudobradya** G. O. Sars, 1904

131. Terminal segment of endopods of second legs enormously lengthened; basal expansion of fifth leg very narrow and tipped with 1 seta; littoral, among algae.
♂ ♀ **Longipedia** Claus, 1863 (p. 170)
Second endopod not lengthened; basal expansion of fifth leg wide, with several setae; first antennae 17-segmented, basal segments enlarged; pelagic, surface tow.
♀ **Benthomesophria** G. O. Sars, 1909
Second endopod not lengthened; basal expansion of fifth leg very short, with 5 setae; first antennae 5-segmented, long aesthetask on third segment; marine, Banyuls.
♀ **Tisemus** Monard, 1928
Second endopod not lengthened; first antennae 6- to 9-segmented ---------- 132
132. One or both rami of first legs prehensile, armed with claws ---------- 133
Both rami of first legs natatory, armed with plumose setae ---------- 160
133. Exopods of first legs distinctly longer than endopods ---------- 134
Endopods of first legs distinctly longer than exopods ---------- 135
Rami of first legs equal or subequal ---------- 155
134. Exopod of second antenna 4-segmented; exopod of first legs tipped with 5 or 6 short curved claws, subequal; fifth legs small, not reaching ovisac; littoral, brackish pools.
♂ ♀ **Tigriopus** Norman, 1868
Exopod of second antenna 2-segmented; exopod of first legs tipped with 2 or 3 long unequal claws; fifth legs large, often covering the ovisacs; littoral, among algae.
♂ ♀ **Thalestris** Claus, 1863 (p. 201)
Exopod of second antenna 2-segmented; exopod of first leg tipped with 4 subequal curved claws; fifth legs small; first antennae 7-segmented; Lake Baikal ---- ♂ ♀ **Harpacticella** Sars, 1908
135. Metasome passing insensibly into urosome; basal segment of first endopod usually longer than entire exopod ---------- 136
Metasome abruptly narrowed at fifth segment; basal segment of first endopod longer than entire exopod ---------- 140
Metasome abruptly narrowed at fifth segment; basal segment of first endopod not longer, usually shorter, than exopod ---------- 142
136. Exopod of second antenna 2-segmented, distal segment the longer; distal segment of fifth legs usually with 6 unequal setae, basal expansion with 4 setae; moderate depths.
♂ ♀ **Schizopera** G. O. Sars, 1905
Exopod of second antenna made up of a single segment ---------- 137
Exopod of second antenna 2-segmented, proximal segment the longer -- 138
Exopod of second antenna 3-segmented, middle segment very short --- 139
137. First antennae of female straight; end segment of second endopod with 1 inner and 2 apical setae, and 1 apical spine; rostrum obsolete; littoral, among algae - ♂ ♀ **Ameira** Boeck, 1865 (p. 244)
First antennae of female geniculate at third segment; end segment of second endopod with 2 inner, 2 apical setae, 1 spine; rostrum large; parasitic on a worm.
♀ **Nitocrameira** Liddell, 1912
First antennae of female geniculate at second segment; end segment of second endopod with 2 inner, 1 apical setae, 1 spine; rostrum short and blunt; muddy bottoms.
♂ ♀ **Diosaccopsis** Brian, 1925

138. Caudal rami as wide as long, their apical setae as long as urosome; end segment of fifth legs three times as long as wide, with 5 setae; littoral, among algae-- ♂ ♀ **Ameiropsis** G. O. Sars, 1907

Caudal rami six to ten times as long as wide, their apical setae as long as entire body; end segment, fifth legs, five to nine times as long as wide; muddy bottom, shallow. ♂ ♀ **Stenocopia** G. O. Sars, 1907

139. End segment of second endopod with 1 inner, 2 apical setae, 1 apical spine, much modified in male; basal expansion of fifth leg large; littoral, among algae. ♂ ♀ **Amphiascus** G. O. Sars, 1905 (p. 215)

End segment of second endopod with 3 inner and 3 apical setae, no apical spine; basal expansion of fifth leg obsolete, end segment elongate; pelagic, surface tow----- ♀ **Eremopus** Brady, 1910

140. Basal segment of first endopod triangular, half as wide as long; exopod natatory; fifth legs of medium size, end segment with 5 or 6 setae; among algae--------- ♂ ♀ **Idomene** Philippi, 1843

Both rami of first legs prehensile, basal segment of endopod three to five times as long as wide------------------------------ 141

141. Exopod of second antenna 3-segmented, 7 setae; inner seta of first endopod at center of basal segment; fifth legs with transverse chitin ribs; littoral, among algae. ♀ **Dactylopusia** Norman, 1903 (p. 206)

Exopod of second antenna 1-segmented, 4 setae; inner seta of first endopod at tip of basal segment; fifth legs without transverse chitin ribs; littoral, among algae ♂ ♀ **Diosaccus** Boeck, 1872 (p. 213)

Exopod of second antenna 1-segmented, 3 setae; inner seta of first endopod at base of basal segment; fifth legs without transverse ribs; littoral, among algae-- ♀ **Dactylopusioides** Brian, 1928

142. Middle segments of second, third, and fourth endopods each with 2 setae-- 143

Middle segments of second, third, and fourth endopods each with 1 seta-- 146

Setae on middle segments of second, third, and fourth endopods not uniform-- 150

143. Basal segment of first endopod shorter than 2 distal segments combined; metasome depressed; spines of first exopods with tufted cilia; littoral and pelagic- ♂ ♀ **Tisbe** Lilljeborg, 1853 (p. 195)

Basal segment of first endopod longer than 2 distal segments combined; no tufted cilia on spines of first exopods--------------- 144

144. Endopod of second legs 1-segmented, but longer than entire exopod, with 1 seta on each side near the base and 2 inside near the tip; among algae-------------------- ♀ **Flavia** Brady, 1899

Endopod of second legs normal, 3-segmented------------------------ 145

145. Spines on end segments of first legs long, nearly straight, and fimbriated, the rami themselves neither widened nor flattened; littoral, shallow----------------- ♀ **Idyanthe** G. O. Sars, 1909

Spines on end segments of first legs short, curved, and pulvilliform, the rami themselves considerably broadened and flattened; littoral, among algae---------- ♀ **Scutellidium** Claus, 1866

146. Basal segment of first endopod shorter than 2 distal segments combined; rostrum lacking; body cylindrical, stout; caudal rami short, wide; muddy bottom, shallow-- ♀ **Sarsameira** Wilson, 1924
Basal segment of first endopod longer than 2 distal segments combined; rostrum present; second endopod not modified in male-- 147

147. Caudal rami 10 to 20 times as long as wide; rami of swimming legs long and slender; basipods often geniculate, projecting laterally; muddy bottom, shallow---- ♂ ♀ **Stenocopia** G. O. Sars, 1905
Caudal rami only one to five times as long as wide------------------ 148

148. Exopod of second antenna 1-segmented; terminal segment of second endopod with 1 inner, 2 apical setae and 1 apical spine --- 149
Exopod of second antenna 2-segmented; end segment of second endopod with 2 inner, 2 apical setae, 1 apical spine; caudal rami as wide as long, and blunt; littoral, among algae. ♂ ♀ **Ameiropsis** G. O. Sars, 1907

149. Middle segment of first exopod without inner seta; anal operculum and anal segment with smooth margins; second maxillae with 1 inner lobe; littoral, among algae. ♂ ♀ **Ameira** Boeck, 1865 (p. 244)
Middle segment of first exopod with inner seta; anal operculum and anal segment with spiny margins; second maxillae with 2 inner lobes; littoral, among algae. ♂ ♀ **Nitocra** Boeck, 1865 (p. 240)

150. Middle segment of second endopod with 1 seta, of third and fourth endopods each with 2 setae; second endopod conspicuously modified in male; littoral, tide pools. ♂ **Dactylopusia** Norman, 1903 (p. 206)
Middle segment of second and third endopods with 2 setae, of fourth endopod with a single seta------------------------------ 151
Middle segment of second endopod with 2 setae, of third and fourth endopods each with a single seta--------------------------- 153

151. End segment of fifth legs long and narrow; body short, depressed; rostrum much reduced; exopod of second antennae 3- or 4-segmented; littoral, moderate depth. ♀ **Idyanthe** G. O. Sars, 1909
End segment of fifth legs foliaceous, short and wide; body stout and compressed laterally; second endopods modified in male-- 152

152. Exopod of second antenna 1-segmented; metasome compressed, but much wider than urosome; segments of fifth legs fused in male, separate in female; littoral, among algae. ♂ **Diosaccus** Boeck, 1872 (p. 213)
Exopod of second antenna 3-segmented; metasome but little wider than urosome; segments of fifth legs separated in both sexes, very wide; moderate depths, among algae. ♂ **Amphiascus** G. O. Sars, 1905 (p. 215)

153. Caudal rami narrow, elongate, and widely divergent; body also elongate and subcylindrical; urosome fully as wide as metasome; pelagic, surface tow. ♂ ♀ **Halithalestris** G. O. Sars, 1905 (p. 202)
Caudal rami short, stout, and parallel------------------------------ 154

154. Rostrum triangular, as wide as long; body stout and pyriform; end segment of fifth leg reaching its entire length beyond basal expansion; muddy bottom, shallow. ♂ ♀ **Stenhelia** Boeck, 1864 (p. 228)

Rostrum narrow, longer than wide; body slender, cylindrical; end segment of fifth leg reaching but little beyond its basal expansion; littoral, among algae----- ♂ ♀ **Parathalestris** Brady, 1873

Rostrum obtuse, wider than long; body broad, depressed; end segment of fifth leg reaching two-thirds beyond basal expansion, with 4 setae; littoral, in sand. ♂ ♀ **Machairopus** Brady, 1883

155. Fifth legs of female enormous, entirely covering ovisac, of male smaller, basal expansion slight, armed with 2 unequal setae; littoral, among algae---- ♂ ♀ **Phyllothalestris** G. O. Sars, 1905

Fifth legs of female large, but covering only proximal end of ovisac, of male small, basal expansion armed with 3 setae-------- 156

156. Body strongly depressed, shield-shaped; no rostrum; end segment of fifth leg three times as long as wide; caudal rami wider than long; moderate depths------ ♂ ♀ **Amenophia** Boeck, 1865

Body not shield-shaped; rostrum present; end segment of fifth legs foliaceous in female, twice as wide as long in male-------- 157

157. Caudal rami narrow, four times as long as wide, divergent, without lateral setae; body subcylindrical and large; pelagic, surface tow--- ♂ ♀ **Halithalestris** G. O. Sars, 1905 (p. 202)

Caudal rami not more than twice as long as wide, and parallel, with lateral spines or setae------------------------------------ 158

158. Exopod of second antenna 3-segmented; rostrum prominent and mobile; caudal rami twice as wide as long; second endopod modified in the male; moderate depths, among algae. ♂ ♀ **Rhynchothalestris** G. O. Sars, 1905

Exopod of second antenna 2-segmented; rostrum smaller, but mobile; caudal rami as long as wide or longer-------------------- 159

Exopod of second antenna 1-segmented; rostrum very small, immobile; caudal rami little wider than long; second endopod not modified in male; littoral, among algae. ♂ ♀ **Nitocra** Boeck, 1865 (p. 240)

159. Body slender, compressed laterally, urosome nearly as wide as metasome; fifth legs of moderate size; rostrum large, mobile; littoral, tide pools---------------- ♂ ♀ **Parathalestris** Brady, 1873

Body stout, often depressed, metasome wider than urosome; fifth legs large, sometimes covering half the ovisac; rostrum immobile; littoral, among algae-- ♂ ♀ **Thalestris** Claus, 1863 (p. 201)

160. Exopod of second antenna 1- or 2-segmented------------------------ 161

Exopod of second antenna 3- or 4-segmented------------------------ 165

161. Endopod of second antenna 2-segmented, exopod attached to side of basal endopod segment and itself 1- or 2-segmented-------- 162

Endopod of second antenna 3-segmented, exopod attached to distal corner of basal endopod segment, and itself 2-segmented-- 163

Endopod of second antenna 3-segmented, exopod 1-segmented; end segment of fifth legs three times as long as wide, both margins fringed with hairs; muddy bottom, 60 fathoms. ♀ **Argestes** G. O. Sars, 1910

162. Basal expansion of fifth legs in female wider than end segment, with 5 subequal setae, in male narrower, with 2 setae; muddy bottom, shallow--- ♂ ♀ **Robertsonia** Brady, 1880

Basal expansion of fifth legs in female not wider than end segment, with 4 unequal setae, the second outer seta very much elongated (Norwegian fiords)-- ♀ **Pseudameira** G. O. Sars, 1911

163. Endopod of first leg nearly twice as long as exopod, its basal segment widened; metasome depressed, one-third wider than the urosome; Norwegian coast, 12 fathoms. ♀ **Tachidiella** G. O. Sars, 1909

Rami of first leg subequal; basal endopod segment not widened--------- 164

164. Metasome compressed laterally, no wider than urosome; basal expansion of fifth leg with 2 setae, end segment 3-lobed, with 3 setae; muddy sand, shallow--- ♀ **Pseudobradya** G. O. Sars, 1904

Metasome compressed laterally, wider than urosome; basal expansion of fifth leg with 1 seta, end segment not lobed, with 2 setae; surface tow (New Zealand)------ ♀ **Phroso** Brady, 1899

165. Exopod of second antenna 4-segmented; basal expansion of fifth legs entirely lacking, or nearly so, without setae--------------- 166

Exopod of second antenna 3-segmented; basal expansion of fifth legs well developed and armed with plumose setae------------ 169

166. Rostrum broadly triangular and prominent; genital segment with a short spiny projection on either side at the posterior corner--- 167

Rostrum small and insignificant; genital segment with smooth posterior corners, without spiny projections---------------------- 168

167. Caudal rami so closely appressed as to appear fused, 10 to 20 times as long as wide; second segment of first antenna without a spine; pelagic, 100 fathoms---- ♀ **Cerviniopsis** G. O. Sars, 1903

Caudal rami separated, four or five times as long as wide; second segment of first antenna with a stout, acute spine on its outer margin; pelagic, 50 fathoms---- ♀ **Eucanuella** T. Scott, 1901

168. Basal segment of second endopod with 2, of third endopod with 1, large spine on inner margin; caudal rami five to ten times as long as wide; muddy bottoms---- ♀ **Cervinia** Norman, 1878

Basal segments of second and third endopods with normal setae, no spines; caudal rami only a very little longer than wide; sandy bottoms-------------- ♂ ♀ **Tachidiopsis** G. O. Sars, 1911

169. Body compressed, urosome as wide as metasome; distal exopod segment of second antenna longer than the 2 proximal segments combined-- 170

Body depressed, metasome wider than urosome; middle exopod segment of second antenna very short, the other 2 segments much longer-- 171

170. Middle apical seta of caudal rami as long as the body; inner seta of end segment of fifth leg very short, weak, and rudimentary; pelagic, surface tow. ♂ ♀ **Microsetella** Brady and Robertson, 1873 (p. 176)

Middle apical seta of caudal rami shorter than urosome; inner seta of end segment of fifth leg as long and stout as the outer; muddy bottoms------------------ ♂ **Pseudobradya** G. O. Sars, 1904

171. Fifth legs small, basal expansion with only 1 or 2 setae--------------- 172

Fifth legs large, basal expansion with 5 or 6 setae------------------ 173

172. Basal expansion of fifth legs not reaching midline, with 2 setae; end segment with 3 marginal, 1 dorsal setae, the 2 segments often fused; sandy bottoms------------------ ♂ **Bradya** Boeck, 1872

Basal expansion of fifth legs on the midline, with 1 seta only, far removed from the end segment, which is armed with 4 marginal setae; muddy bottoms- ♂ ♀ **Pseudotachidius** T. Scott, 1898

173. Each basal expansion of fifth legs with 6 setae and an inner fringe of interlaced spines; end segment spatulate, also with 6 stout setae; beach sands------ ♂ ♀ **Rathbunula**, new genus (p. 297)

Each basal expansion of fifth legs with 5 setae, without the fringe of spines; end segment broad and laminate, with 4 or 5 smallish setae; littoral, among algae--- ♀ **Thompsonula** T. Scott, 1905

174. Exopod of second antenna 1-segmented, often rudimentary----------- 175

Exopod of second antenna 2-segmented---------------------------- 176

Exopod of second antenna 3-segmented---------------------------- 178

Exopod of second antenna 6- or 7-segmented---------------------- 180

175. Endopod of second antenna 3-segmented, exopod rudimentary, with a single minute seta; thoracic segments without spines; fifth leg normal; pelagic------------ ♀ **Hensenella** Dahl, 1895

Endopod of second antenna 2-segmented; first 4 thoracic segments each with a stout dorsal spine; fifth leg leaf-like, with 4 simple setae; pelagic (Antarctic Ocean).
♀ **Tetanopsis** Brady, 1910

Endopod of second antenna 4-segmented; thoracic segments without spines; fifth leg linear, with 2 apical and 3 outer lanceolate, dentate setae; pelagic, surface tow.
♂ ♀ **Aegisthus** Giesbrecht, 1891 (p. 304)

176. Basal segment of first endopod the same length and width as second segment; end segment with 4 setae; fifth leg angular, in female 8, in male 6 setae; brackish water.
♂ ♀ **Tachidius** Lilljeborg, 1853 (p. 294)

Basal segment of first endopod much longer than second segment-------- 177

177. Fifth leg divided by a median sinus into 2 rounded lobes, each with 5 setae; first endopod with 2 stout apical claws and 1 seta; littoral, shallow------------------ ♀ **Idomenella** T. Scott, 1906

Fifth leg tapered to a single blunt apex, with 4 setae and 2 spines; first endopod with 3 weak apical setae, without the claws; washed from dredgings-------- ♂ ♀ **Alteuthella** A. Scott, 1909

178. Endopod of second legs 2-segmented, much modified; segments of fifth legs fused; each with 3 or 4 setae; rudiments of sixth legs behind the fifth pair; muddy bottoms.
♂ **Stenhelia** Boeck, 1864 (p. 228)

Endopod of second legs 3-segmented and unmodified----------------- 179

179. Segments of first endopod the same length, end segment with 5 setae; each fifth leg 2-lobed, outer lobe with 4, inner with 2 setae; littoral, 30 fathoms------------------ ♀ **Bradya** Boeck, 1872

End segment of first endopod much the longest, with 2 pectinated spines and 2 inner setae; each fifth leg 1-lobed, with 4 setae; beach sands----------- ♀ **Echinocornus**, new genus (p. 301)

End segment of first endopod the longest, with 3 apical and 1 inner seta; each fifth leg a minute 1-segmented lamina with 5 unequal setae; littoral, 2 fathoms-------- ♀ **Brianola** Monard, 1926

180. Head fused with first segment; urosome much longer than metasome; genital segment without dorsal suture; exopod of second antenna 6-segmented; littoral, moderate depths. ♀ **Sunaristes** Hesse, 1867

Head separated from first segment; urosome shorter than metasome; genital segment with dorsal suture; exopod of second antenna 7-segmented ---------- 181

181. Exopods of first 4 pairs of legs with inner setae; endopod of second antenna 2-segmented; caudal rami divergent; fifth leg rudimentary, 4 setae; littoral, among algae. ♂ ♀ **Canuella** T. Scott, 1893 (p. 171)

Exopods of first 4 pairs of legs without inner setae; endopod of second antenna 3-segmented; caudal rami parallel; fifth leg lamellar, 5 setae; littoral, moderate depths- ♀ **Canuellina** Gurney, 1927

KEY TO THE GENERA OF THE SUBORDER CYCLOPOIDA

(In addition to the segmentation of the swimming legs, the structure of the second antennae and the fifth legs is of special systematic value.)

1. Each ramus of the first 4 pairs of legs 3-segmented ---------- 2

Each ramus of the first 4 pairs of legs 2-segmented ---------- 76

Each ramus of the first 4 pairs of legs 1-segmented ---------- 81

Rami of the first 4 pairs of legs unevenly segmented, or lacking ---------- 82

2. Second antenna biramose, endopod 4-segmented, exopod attached to outer side or distal corner of second endopod segment ---------- 3

Second antenna uniramose, 5-segmented, the exopod lacking ---------- 21

Second antenna uniramose, 4-segmented, the exopod lacking ---------- 23

Second antenna uniramose, 3-segmented, the exopod lacking ---------- 59

Second antenna uniramose, 2-segmented, the exopod lacking ---------- 71

3. Urosome of female 3-segmented, of male 4-segmented ---------- 4

Urosome of female 4-segmented, of male 5-segmented ---------- 12

4. Outline of metasome circular or transversely elliptical, distinctly wider than long; oral cone short and ovate ---------- 5

Outline of metasome oval or longitudinally elliptical, distinctly longer than wide; oral cone pear-shaped ---------- 6

5. Metasome and genital segments without epimeral plates, diminishing regularly in width; first antenna 18-segmented, fourth segment without posterior spine; parasitic on starfish. ♀ **Scottomyzon** Giesbrecht, 1897

Metasome and genital segments with epimeral plates, second and fourth segments abruptly narrowed; first antenna 17-segmented, fourth segment with posterior spine; sponge washings, Ceylon ---------- ♀ **Doropontius** Thompson and Scott, 1903

6. Second antenna as long as first, its exopod longer than third endopod segment, with 1 apical and 1 outer seta; oral tube reaching caudal rami; host unknown--- ♂ ♀ **Acontiophorus** Brady, 1880

Second antenna much shorter than first, its exopod shorter than third endopod segment; oral tube much shorter, sometimes lacking ---------- 7

7. Oral cone not produced, sucking tube entirely lacking ---------- 8

Oral cone produced into a sucking tube of moderate length ---------- 10

8. Caudal rami 10 times as long as wide; end segment of fifth leg as wide as long, with 4 tiny setae; second antenna with 2 apical setae; dredged, 30 fathoms- ♀ **Mesocheres** Norman and Scott, 1905

Caudal rami as wide as long or wider; end segment of fifth leg much longer than wide, with 3 apical setae ---------- 9

9. Urosome 3-segmented; genital segment spindle-shaped, its posterior margin no wider than the abdomen, with no trace of sixth legs at the corners; sponge washings (Ceylon).
♀ **Asteropontius** Thompson and Scott, 1903

Urosome 4-segmented; genital segment quadrangular, its posterior margin twice as wide as abdomen, with rudimentary sixth legs at the corners; parasitic on starfish.
♂ **Scottomyzon** Giesbrecht, 1897

10. Sucking tube reaching fifth metasome segment; caudal rami half as long as anal segment; end segment of fifth leg lamelliform, with 3 apical setae; dredged, 20 fathoms.
♂ ♀ **Scottocheres** Giesbrecht, 1897

Sucking tube not reaching first legs except in one species of Asterocheres; caudal rami as long as anal segment, or longer---------- 11

11. Caudal setae much shorter than urosome; end segment of fifth leg not tapered distally and ciliated only on its inner margin; parasitic on echinids-------------------- ♀ **Echinocheres** Claus, 1889

Caudal setae much longer than urosome; end segment of fifth leg considerably tapered distally and ciliated on both margins; parasitic on starfish--------------- ♂ ♀ **Asterocheres** Boeck, 1859

12. Endopod of fourth leg reduced in size, with minute setae; head and metasome segments with pointed epimeral plates; end segment of fifth leg tiny; pelagic, varying depths.
♂ ♀ **Bradypontius** Giesbrecht, 1895

Endopod of fourth leg not reduced, with setae of normal size; head and most of metasome segments without epimeral plates--------- 13

13. Oral cone pear-shaped, not produced into a sucking tube; endopod of second antenna with an apical spine and 1 or 2 setae---------- 14

Oral cone ovoid and produced into a sucking tube; endopod of second antenna with 3 or more apical plumose setae------------------ 17

14. Rostrum, large, pointed, beak-shaped; third and often the second metasome segments with pointed posterior corners; caudal rami long and slender; dredged, moderate depths.
♂ ♀ **Rhynchomyzon** Giesbrecht, 1895

Rostrum small, blunt; second and third segments with rounded corners-- 15

15. Caudal rami and end segment of fifth leg little longer than wide; the latter with 2 setae, 2 spines, and a bristle; urosome segments pointed; dredged, moderate depths.
♂ ♀ **Dermatomyzon** Claus, 1889

Caudal rami four to ten, end segment of fifth leg three to eight times as long as wide; urosome segments rounded------------------- 16

16. Oral cone truncated, with 2 diverging apical tentacles; caudal rami four, end segment of fifth leg three times as long as wide, with 3 apical setae; dredged, moderate depths.
♀ **Leptomyzon** G. O. Sars, 1915

Oral cone bluntly rounded, without tentacles; caudal rami ten, end segment of fifth leg in female eight, in male four, times as long as wide; dredged, 30 fathoms------- ♂ ♀ **Collocheres** Canu, 1893

17. Sucking tube short and enlarged into a disk at its tip; each fifth leg replaced by a single seta; head and caudal rami as wide as long; dredged, 1,000 fathoms-------- ♀ **Pontoeciella** Giesbrecht, 1895

Sucking tube short, without a disk; fifth leg 2-segmented or lacking-- 18

Sucking tube elongate, without a disk; fifth leg 1-segmented----------- 19

18. Head longer than wide; caudal rami four times as long as wide; fifth leg 2-segmented, its basal segment very short and fused with the body; dredged, 20 fathoms---- ♂ ♀ **Neopontius** T. Scott, 1898

Head much wider than long; caudal rami also wider than long; fifth leg wholly lacking; genital segment inflated, deeply cleft laterally; dredged, 385 meters------ ♀ **Dystrogus** Giesbrecht, 1899

19. Metasome segments without epimeral plates; caudal rami four times as long as wide; sucking tube reaching posterior margin of head; dredged, 40 fathoms---- ♂ ♀ **Myzopontius** Giesbrecht, 1895

Metasome segments with long, pointed epimeral plates; caudal rami about as wide as long------------------------------------ 20

20. Posterior corners of head conspicuously notched; epimeral plates pointed diagonally outward; genital segment about as long as wide, dredged, moderate depths.
♀ **Cribropontius** Giesbrecht, 1899

Posterior corners of head entire; epimeral plates curved backward parallel with body axis; genital segment twice as wide as long; dredged, moderate depths-- ♀ **Sestropontius** Giesbrecht, 1899

21. Metasome little wider than urosome; rostrum lacking; basal segment of second antenna the longest, end segment with 6 curved apical setae; dredged, moderate depths.
♀ **Pseudopsyllus** T. Scott, 1902

Metasome three times as wide as urosome; rostrum present; basal segment of second antenna the shortest----------------------- 22

22. Second antenna prehensile, with a stout apical claw; rostrum visible dorsally; end segment of first exopod with 4 spines, 4 setae; dredged, 100 fathoms---- ♂ ♀ **Rhinomolgus** G. O. Sars, 1918

Second antenna nonprehensile, with apical setae; rostrum not visible dorsally; end segment of first exopod with 2 spines, 6 setae; dredged, 20 fathoms------ ♀ **Hemicyclops** Boeck, 1873 (p. 345)

23. Fifth leg lacking, or replaced by 1 or 2 setae------------------------ 24

Fifth leg made up of a single distinct segment------------------------ 31

Fifth leg made up of 2 segments------------------------------------ 46

Fifth leg made up of 3 segments------------------------------------ 55

Fifth leg 4-segmented, distal segment with 4 subequal setae; second antenna with 7 curved apical setae; caudal rami 7 times as long as wide; dredged, moderate depths.
♂ **Cyclopinodes**, new genus (p. 319)

24. Second antennae prehensile, with terminal claws----------------------- 25

Second antennae nonprehensile, with terminal setae------------------ 28

25. Second antenna with 1 apical claw; first antenna 6-segmented---------- 26

Second antenna with 2 or 3 claws; first antenna with 8 or more segments-- 27

26. Caudal rami lamellar, half as long as urosome, divergent, with minute setae; second antenna no longer than first, claw short and straight; pelagic, 600 meters---------- ♀ **Urocopia** G. O. Sars, 1917

Caudal rami cylindrical, little longer than anal segment, parallel, with long setae; second antenna much longer than first, claw strongly curved; gills of fishes. ♂ ♀ **Ergasilus** (part) Nordmann, 1832 (p. 375)

27. Second antenna with 2 apical claws; first antenna 8-segmented, second segment longer than 4 end segments combined; caudal rami twice as long as wide; parasitic on starfish. ♀ **Astericola** Rosoll, 1888

Second antenna with 3 apical claws; first antenna 10-segmented, segments equal; caudal rami five times as long as wide; fifth legs wholly lacking; in an ascidian---------- ♀ **Uperogcos** Hesse, 1867

28. Head fused with first segment; thorax with epimeral plates------------- 29

Head separated from first segment; thorax without epimeral plates-- 30

29. Metasome with rounded epimeral plates; first antenna 10-segmented, first and sixth segments largest; each fifth leg replaced by 3 stout ciliated spines; fresh water. ♂ ♀ **Ectocyclops** Brady, 1904 (p. 340)

Metasome with pointed epimeral plates; first antenna 9-segmented, first and third segments largest; each fifth leg replaced by 2 filiform setae (Antarctic Ocean)- ♀ **Urogonia** Brady, 1910

30. Metasome pyriform, one-half longer than wide; first antenna 8-segmented, more or less fused in female; fifth leg a knob with 2 apical, 2 basal setae; surface, moderate depths. ♂ ♀ **Pachos** Stebbing, 1910

Metasome of female short and squat, of male long and clavate; first antenna 4-segmented and sparsely setose; fifth legs wholly lacking; in compound ascidian. ♂ ♀ **Ophthalmopachus** Hesse, 1866

31. Second antennae prehensile, armed with strong curved claws----------- 32

Second antennae nonprehensile, armed with plumose setae------------- 40

32. Fourth segment of second antenna definitely longer than third segment-- 33

Fourth segment of second antenna equal with third segment, or shorter-- 37

33. Body cyclops-like, metasome four or five times as wide as urosome, its width half the body length; only slightly depressed-- 34

Body elongated, metasome but little wider than urosome, its width one-third the body length or less; strongly depressed--------- 36

34. Metasome three times as long as urosome; fifth leg with inside knob and outside seta at base, representing basal segment; dredged, moderate depths------------- ♂ ♀ **Hermannella** Canu, 1891

Metasome less than twice as long as urosome; fifth leg without any trace of a basal segment-- 35

35. Genital segment a little wider than long; fifth leg twice as long as wide, with a coarse inner spine and an outer seta at the tip; parasitic on *Pecten* ---------------- ♀ **Pestalichomolgus**, new name[24]
Genital segment much longer than wide; fifth leg three times as long as wide, with 2 equal filiform setae at its distal end; in coelenterates ------------------------- ♀ **Paranthessius** Claus, 1889
36. Metasome narrowed to a blunt point anteriorly and without chitin frontal lenses; second antenna with 2 curved apical claws and 3 setae; littoral, shallow water --- ♀ **Lubbockia** Claus, 1863
Metasome broadly rounded anteriorly, with a pair of large chitin frontal lenses; second antenna with a single stout apical claw; in tunicates - ♂ ♀ **Sapphirina** J. V. Thompson, 1829 (p. 363)
37. Second segment of second antenna with a row of 6 stout teeth on its inner surface, third segment with a curved claw, end segment with 3 claws; gills of *Sabella* ---- ♀ **Sabelliphilus** M. Sars, 1862
Second segment of second antenna without teeth, third without a claw -- 38
38. End segment of second antenna with a curved claw and short spine, subchelate; fifth body segment wider than fourth; fifth leg with 2 equal setae; in a holothurian. ♀ **Diogenidium** C. L. Edwards, 1891
End segment of second antenna with 3 curved claws and 2 setae; fifth body segment narrower than the fourth; setae of fifth leg very unequal -- 39
39. Caudal setae no longer than last 2 segments of abdomen; fifth leg twice as long as wide, with 2 setae; second segment of fourth endopod with 1 seta; pallial cavity of mussels. ♂ ♀ **Modiolicola** Aurivillius, 1883
Caudal setae longer than entire urosome; fifth leg four times as long as wide, with 4 setae; second segment of fourth endopod with 2 inner setae; in opisthobranch mollusks. ♂ ♀ **Anthessius** Della Valle, 1879
40. Urosome 5-segmented in both sexes; genital segment much widened in female, with posterior spines in male; fifth leg with 3 spines and 1 bristle; sponge and oyster washings. ♂ ♀ **Hersiliodes** Canu, 1888
Urosome 4-segmented in female, 5-segmented in male; genital segment scarcely widened in female, without spines in male ---------- 41
41. Fourth segment of second antenna longer than third; anal segment of abdomen longer than preceding segment ----------------- 42
Fourth segment of second antenna shorter than third, or of equal length; anal segment shorter than preceding segment ----- ----- 44
42. First antenna short and stout, 6-segmented, first segment with stout posterior spine; fifth leg 3, caudal rami 10 times as long as wide; muddy bottom, 60 fathoms -- ♀ **Hippomolgus** G. O. Sars, 1917
First antenna slender, 9- or 17-segmented, no spine on first segment; fifth leg and caudal rami not as above ---------------------- 43
43. Fifth leg and caudal rami as wide as long, the former with 1 apical, 1 outer, and 1 inner seta; first antennae 9-segmented, short; muddy sand, 40 fathoms -------- ♀ **Cyclopetta** G. O. Sars, 1913
Fifth leg and caudal rami nearly twice as long as wide, the former with 1 apical, 1 outer seta, 1 inner spine; first antenna 17-segmented; fresh water ------ ♀ **Macrocyclops** Claus, 1893 (p. 332)

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[24] Pesta's name *Pseudolichomolgus*, 1909, was preoccupied in 1898 (see 77).

44. Middle segment of first endopod with 2 inner setae; middle seta of fifth leg longer than outer one, both filiform; first antenna 12-segmented; fresh water, bottom form.
♂ ♀ **Eucyclops** Claus, 1893 (p. 337)
Middle segment of first endopod with 1 inner seta; outer seta of fifth leg longer than middle one; metasome strongly flattened--------- 45

45. First antenna slender, 11-segmented, sparsely setose; caudal ramus twice as long as wide, with a dorsal transverse row of spines at its tip; fresh water, littoral------ ♀ **Heterocyclops** Claus, 1893
First antenna stout, 8-segmented, densely setose; caudal ramus five times as long as wide, without a dorsal transverse row of spines; fresh water, bottom form- ♀ **Paracyclops** Claus, 1893 (p. 342)

46. Fourth metasome segment produced on each side into a wing-like process larger than the body; second antenna with 2 apical spines; gills of lobster---- ♀ **Nicothoe** Audouin and Edwards, 1825
No lateral processes on fourth segment; second antenna with 3 apical setae; first antenna 5-segmented, its aesthetask twice as long as the antenna; littoral, moderate depths.
♀ **Ratania** Giesbrecht, 1892
No lateral processes on fourth segment; second antenna with 6 or 7 long curved apical setae-- 47

47. Third and fourth metasome segments fused, dorsally overlapping the fifth; endopod segments of first and second legs flattened into broad laminae; on gills of fishes.
♂ ♀ **Artacolax** Wilson, 1908 (p. 383)
Third and fourth metasome segments separated, no overlapping; endopod segments of first and second legs like those of the other 2 pairs--- 48

48. Three basal segments of first antenna fused, enlarged, flattened, with dense fringe of setae; maxillipeds turned forward outside mouth parts; gills of fishes.
♂ ♀ **Bomolochus** (part) Nordmann, 1832 (p. 381)
Basal segments of first antenna neither fused, enlarged, nor flattened; second antenna greatly enlarged; maxillipeds lacking in female; gills of fishes.
♂ ♀ **Ergasilus** (part) Nordmann, 1832 (p. 375)
Basal segments of first antenna neither fused, enlarged, nor flattened; second antenna normal size; maxillipeds present in their usual place behind the outer mouth parts-------------------------- 49

49. End segment of fifth leg with 3 spines and 1 seta; second segment of first endopod with 2 inner setae; caudal rami twice as long as wide; in brine pools---------- ♀ **Neocyclops** Gurney, 1927
End segment of fifth leg with 2 setae, 1 apical and 1 inner-------------- 50
End segment of fifth leg with 3 setae, or spines, or both---------------- 51
End segment of fifth leg with 4 setae, or spines, or both---------------- 52

50. Spines on end segment of exopods 2, 3, 3, 3; apical setae of fifth leg equal in length; lateral body margins not broken at joints; fresh water, everywhere- ♂ ♀ **Mesocyclops** G. O. Sars, 1914 (p. 330)
Spines on end segment of exopods 3, 4, 4, 4; apical setae of fifth leg very unequal; lateral body margins broken or notched at joints; fresh water, everywhere.
♂ ♀ **Cyclops** (part) O. F. Müller, 1776 (p. 322)

51. End segment of fifth leg obtusely truncated, with lanceolate spines at corners, between them a filiform seta; first antennae 10-segmented; marine, littoral----- ♂ ♀ **Cyclopina** Claus, 1863 (p. 317)
End segment of fifth leg 3-lobed, each lobe with a plumose seta; metasome tumid and boldly vaulted; first antennae 17-segmented; fresh water, everywhere. ♂ ♀ **Macrocyclops** Claus, 1893 (p. 332)
52. Caudal rami seven or eight times as long as wide; end segment of fifth leg bluntly rounded, with 2 apical and 2 outer setae, all 4 equal; littoral, among algae---------- ♂ ♀ **Giardella** Canu, 1888
Caudal rami much shorter, except in one species of *Euryte*------------- 53
53. Body cylindrical, metasome segments only slightly narrowed posteriorly; first antenna 6-segmented, second pair with 2 apical claws, 3 setae; mantle cavity of clams. ♀ **Myicola** Wright, 1885 (p. 346)
Body cyclopoid, metasome dilated and flattened, its segments strongly narrowed posteriorly------------------------------------- 54
54. First antennae 7-segmented; end segment of fifth leg broadly lamellar, ciliated on both margins; caudal rami little longer than wide; littoral, among stones- ♀ **Hemicyclops** Boeck, 1873 (p. 345)
First antennae 20- or 21-segmented; end segment of fifth leg narrowly lamellar, margins smooth; caudal rami much longer than wide; littoral, among algae------------ ♂ ♀ **Euryte** Philippi, 1843
55. Second antennae nonprehensile, with 6 to 8 apical setae--------------- 56
Second antennae prehensile, with 1 or more apical claws--------------- 58
56. Head separated from first metasome segment; first antenna 12-segmented, the ninth segment the longest; caudal rami three or four times as long as wide; muddy bottom. ♂ ♀ **Cyclopinella** G. O. Sars, 1913
Head fused with first metasome segment; end segment of second antenna longer than preceding segment ---------------------------- 57
57. First antennae 20-segmented; caudal rami six times as long as wide; end segment of fifth leg with 4 unequal setae; fifth leg of male 4-segmented; dredged, moderate depths. ♀ **Cyclopinodes**, new genus (p. 319)
First antennae 16-segmented; caudal rami three times as long as wide; end segment of fifth leg with 2 subequal setae; fifth leg of male 3-segmented; fresh water. ♂ ♀ **Orthocyclops** Forbes, 1897 (p. 329)
58. Metasome cylindrical in female, scarcely narrowed posteriorly, pyriform in male; second antenna with 1 apical claw; first antenna 7-segmented; gills of clams- ♀ ♂ **Myicola** Wright, 1885, (p. 346)
Metasome pyriform in both sexes, narrowed posteriorly; second antenna with 5 curved apical and unequal claws; first antenna 5-segmented; rectum of *Echiurus*-------- ♂ ♀ **Goidelia** Embleton, 1901
59. Fifth leg replaced by 1 or more setae--------------------------------- 60
Fifth leg made up of a single segment-------------------------------- 62
Fifth leg made up of 2 segments-------------------------------------- 68
60. Fifth leg replaced by 1 seta; second antenna nearly as long as first, its end segment with 4 long setae on the inner margin near the tip; pelagic, 2,000 fathoms---- ♂ ♀ **Conaea** Giesbrecht, 1891
Fifth leg replaced by 2 setae; second antenna much shorter than first -- 61

61. Setae of fifth leg short and unequal; second antenna half as long as first, its end segment with 2 unequal apical claws and no setae; parasitic on echinoderms------------ ♀ **Astericola** Rosoll, 1888

Setae of fifth leg long and equal; second antenna one-fourth as long as first, its end segment with 6 long apical setae, 2 of them geniculate; pelagic, at surface. ♂ ♀ **Oithonina** G. O. Sars, 1913 (p. 316)

62. Second antennae prehensile, with 1 or more apical claws--------------- 63

Second antennae nonprehensile, with setae only, no claws--------------- 67

63. Second antenna much shorter than first pair, with 1 apical claw--------- 64

Second antenna much shorter than first pair, with 2 apical claws; fifth leg with 4 equal spines; first antenna elongate and 6-segmented; pelagic, moderate depths. ♀ **Pseudolubbockia** G. O. Sars, 1909

Second antenna much shorter than first pair, with 4 or more apical claws-- 65

Second antenna three or four times as long as first pair----------------- 66

64. Head produced on each side in female, not in the male; first antenna 7-segmented, sparsely setose; fifth leg with 3 filiform setae; pallial cavity of mollusk---- ♂ ♀ **Conchocheres** G. O. Sars, 1918

Head smooth in female; a maxillary hook behind each second antenna; first antenna 8- to 10-segmented; fifth leg with numerous filiform setae; gills of fishes----- ♀ **Haemaphilus** Hesse, 1871

65. Apical claws of second antenna equal and jointed at the center; fifth leg narrow oblong, with 3 spines and 1 filiform seta; pelagic, 100 fathoms----------- ♂ ♀ **Pseudomolgus** G. O. Sars, 1916

Apical claws of second antenna very unequal and not jointed; fifth leg a short and wide lamina with 3 setae and no spines; in an ascidian------------------ ♀ **Lichomolgidium** Kossmann, 1877

66. Head produced laterally on each side; first and second metasome segments fused, half as wide as head; legs visible in dorsal view; gills of fishes------------ ♀ **Macrobrachinus** Hesse, 1871

Head not produced laterally; first 2 metasome segments separated and nearly as wide as head; legs not visible in dorsal view; gills of fishes------------------- ♀ **Megabrachinus** Hesse, 1871

67. Head and 5 metasome segments separated; urosome 4-segmented; caudal rami short and wide, each with 4 apical and 1 lateral setae; marine, littoral----- ♂ ♀ **Oncaea** Philippi, 1843 (p. 350)

First 2 metasome segments fused with the head; urosome 2-segmented; caudal rami long and narrow, each with 1 apical seta; gills of fishes----------- ♀ **Metoponanaphrissontes** Hesse, 1871

68. Body cylindrical, metasome the same diameter throughout; fifth leg with 3 apical setae; first antennae slender, 6-segmented; parasitic on annelids---------- ♀ **Rhodinicola** Levinsen, 1878

Body cyclopoid, metasome widened anteriorly and narrowed posteriorly, and more or less depressed---------------------------- 69

69. Second antenna nonprehensile, with 6 unequal apical setae; end segment of fifth leg triangular, with 4 subequal apical setae; brackish water-------- ♂ ♀ **Halicyclops** Norman, 1903 (p. 320)

Second antenna prehensile, with apical claws but no setae-------------- 70

70. End segment of second antenna with 4 subequal claws; first antennae 6-segmented; maxilliped in normal position, with a stout apical claw; parasitic on *Terebella*-- ♀ **Terebellicola** M. Sars, 1861

End segment of second antenna with 3 unequal claws; first antenna 4-segmented; maxilliped turned forward, with 2 unequal apical setae and no claws; gills of fishes. ♀ **Taeniacanthus** Sumpf, 1871

71. Fifth legs entirely lacking; body long, straight, club-shaped; urosome 4-segmented in female, 5-segmented in male; eye unusually large; in compound ascidians. ♂ ♀ **Ophthalmopachus** Hesse, 1866

Fifth leg made up of a single segment---------------------------------- 72

Fifth leg made up of 2 segments-- 73

72. Fifth leg cylindrical, without setae; second antenna prehensile, with 4 apical claws; caudal rami seven times as long as wide, no setae; parasitic on gastropod---------- ♀ **Panaietis** Stebbing, 1900

Fifth leg conical, with 1 seta; second antenna nonprehensile, with 6 setae; caudal rami twice as long as wide and setose; pelagic, at surface------------------ ♂ ♀ **Oithona** Baird, 1843 (p. 311)

73. Genital segment greatly enlarged, as wide as metasome; end segment of fifth leg eight times as long as wide, setose on both margins; in compound ascidian---- ♀ **Megasanoixus** Hesse, 1871

Genital segment not enlarged; fifth leg much shorter------------------ 74

74. Head half the entire length; metasome segments with projecting corners; caudal rami as long as the last 2 abdominal segments; pelagic, at surface------------------ ♀ **Hyalopontius** G. O. Sars, 1909

Head shorter; metasome segments without projecting corners---------- 75

75. Head one-third the entire length; first antennae 6-segmented, basal segments fused, with flattened spines or setae; fifth leg with 4 end setae; gills of fishes- ♂ ♀ **Artacolax** Wilson, 1908 (p. 383)

Head one-fourth the entire length; first antennae 12-segmented, basal segments not fused, with normal setae; fifth leg with 3 apical setae; fresh water (China)--- ♂ ♀ **Limnoithona** Burckhardt, 1913

76. Body of cyclopoid form; swimming legs normally developed and none of them lacking-- 77

Body cylindrical, spherical, or flattened; swimming legs reduced in size and sometimes rudimentary or lacking---------------- 79

77. Fifth leg 1-segmented, rudimentary; first antenna 7-segmented; second antenna 5-segmented; rostrum anchor-shaped, with 3 spines, outer ones curved; pelagic, at surface. ♀ **Pseudolichomolgus** Thompson and Scott, 1898

Fifth leg 1-segmented, with 2 very unequal setae; a lateral seta on each side of fifth segment; first antenna 11- or 12-segmented; second antenna 4-segmented; fresh water. ♂ ♀ **Microcyclops** Claus, 1893 (p. 325)

Fifth legs made up of 2 distinct segments----------------------------- 78

78. Fifth leg with a long apical seta and a very short lateral spine on the end segment; rami of swimming legs equal in length; fresh water------------ ♂ ♀ **Cyclops** (part) O. F. Müller, 1776 (p. 322)

Fifth leg with long apical and equally long lateral seta on end segment; endopods of swimming legs longer than the exopods; fresh water---------- ♂ ♀ **Mesocyclops** (part) G. O. Sars, 1914 (p. 330)

79. Metasome spherically swollen and five times as long as urosome; third and fourth pairs of legs widely separated, fifth pair lacking; in lamellibranchs---------------- ♀ **Obesiella** Ridewood, 1903
Metasome elongate and cylindrical, or flattened and ovate------------- 80
80. Metasome passing insensibly into urosome; each fifth leg a small knob with 3 setae; second antenna 3-segmented, with 1 stout apical claw; in common mussel--- ♂ ♀ **Mytilicola** Steuer, 1903
Metasome abruptly narrowed into urosome; each fifth leg replaced by 1 small seta; second antenna 4-segmented, with 2 short apical setae; dredged, moderate depths. ♀ **Thoostoma** Wilson, 1924
81. Urosome 4-segmented; body fifteen times as long as wide; first antenna 5-segmented; second antenna 3-segmented, with stout claw; fifth leg replaced by 1 spine; in a gastropod. ♀ **Trochicola** Dollfuss, 1914
Urosome 2-segmented; body five times as long as wide; first antenna 4-segmented; second antenna 3-segmented, with slender apical spine; fifth leg lacking; in a terebellid. ♂ ♀ **Entobius** Dogiel, 1908
82. Rami of first 3 pairs of legs 3-segmented, fourth pair different---------- 83
Rami of second, third, and fourth legs 3-segmented, first pair different--- 109
Endopods and exopods differing in segmentation; one or more pairs of legs often lacking-- 114
83. Exopod of fourth leg 3-segmented, endopod with less than 3 segments-- 84
Exopod of fourth leg 2-segmented, endopod 3-segmented-------------- 102
Exopod of fourth leg 1-segmented, endopod 1-segmented or lacking-- 104
Both rami of fourth leg lacking-- 105
84. Endopod of fourth leg made up of 2 segments-------------------------- 85
Endopod of fourth leg made up of 1 segment--------------------------- 94
Endopod of fourth leg replaced by a seta or spine, or lacking----------- 98
85. Urosome of female 2-segmented; first antenna 5-segmented; second antenna 4-segmented, with 1 apical claw, no exopod; fifth leg replaced by 3 small setae; pelagic, at surface. ♀ **Vettoria** Wilson, 1924
Urosome of female 4-segmented, of male 5-segmented----------------- 86
Urosome of female 5-segmented, of male 5-segmented------------------ 92
86. Second antenna 4-segmented, with 3 apical setae and a tiny 1-segmented exopod; metasome and genital segment with wide epimeral plates; dredged, 20 fathoms. ♀ **Arctopontius** G. O. Sars, 1915
Second antenna 4-segmented, without an exopod------------------------ 87
Second antenna 3-segmented, without an exopod------------------------ 91
87. Fifth leg 2-segmented, basal segment partly fused with thorax---------- 88
Fifth leg 1-segmented, sometimes very rudimentary------------------- 89
88. Second antenna with 2 small apical claws and 3 filiform setae; metasome wider than long, depressed; fifth leg with 2 apical setae; parasitic on pennatulid---------- ♀ **Stellicola** Kossmann, 1877
Second antenna with 7 or 8 curved apical setae; metasome much longer than wide; fifth leg with long apical seta and short spine; fresh water----- ♂ ♀ **Cyclops** (part) O. F. Müller, 1776 (p. 322)

89. Fifth leg reduced to a tiny knob, without setae; second antenna with 2 apical, 1 lateral spines; metasome wider than long, depressed; pelagic, 470 fathoms ------ ♂ ♀ **Metapontius** Hensen, 1923

Fifth leg distinctly 1-segmented, with 2 apical setae ------------------ 90

90. Second antenna with 2 to 4 claws and 1 or 2 setae on end segment; first antenna 7-segmented; end segment of third exopod shorter than other two; in compound ascidians. ♂ ♀ **Lichomolgus** (part) Thorell, 1860

Second antenna with 6 or 7 setae and no claws on end segment; first antenna 6-segmented; end segment of third exopod as long as other 2 combined; marine. littoral ---- ♀ **Onceola** Krämer, 1895

91. Second antenna with 1 stout apical claw; metasome segments with broad epimeral plates; fifth leg 1-segmented, with 2 apical setae; invertebrate washings. ♂ ♀ **Paralichomolgus** Thompson and Scott, 1903

Second antenna with 7 apical setae; metasome segments without epimeral plates; fifth leg 3-segmented, end segment with 4 setae; muddy sand, 30 fathoms ------ ♂ ♀ **Pterinopsyllus** Brady, 1880

92. Metasome wider than long, with lateral epimeral plates; second antenna 3-segmented, with 1 apical claw; fifth leg 1-segmented, with 2 setae; parasitic on *Linkia*. ♂ ♀ **Linkiomolgus** Stebbing, 1900

Metasome much longer than wide, without epimeral plates ------------- 93

93. Fifth leg six times as long as wide, curved; second antenna with 6 apical setae and sometimes a large claw, toothed on the inside; littoral, among algae --- ♂ ♀ **Macrocheiron** Brady, 1872 (p. 348)

Fifth leg twice as long as wide, straight; second antenna with 2 or 3 apical claws, none of them toothed, and 2 or 3 setae; in ascidians ------------------ ♂ ♀ **Lichomolgus** (part) Thorell, 1860

94. Forehead without chitin eye lenses ------------------------------------ 95

Forehead with a pair of large chitin eye lenses ------------------------ 97

95. Fourth endopod three to five, caudal rami two or three times as long as wide --- 96

Fourth endopod not twice as long as wide; caudal rami as wide as long; fifth leg 1-segmented, with 2 tiny equal apical setae; dredged, 20 fathoms ------------- ♀ **Lichomolgella** G. O. Sars, 1918

96. Fifth leg a rounded knob, with 1 spine and 2 filiform setae; fourth endopod with 2 apical setae only; first endopod unmodified in male; parasitic on echinids. ♂ ♀ **Pseudanthessius** Claus, 1889

Fifth leg a flattened lamina, with 3 spines; fourth endopod with 2 apical and 1 inner setae; first endopod much modified in male; littoral, free swimming ---------- ♂ ♀ **Kelleria** Gurney, 1927

97. Head squarely truncated anteriorly; second antenna 4-segmented, slender; fourth metasome segment without processes; caudal rami long, divergent; pelagic, at surface. ♂ ♀ **Copilia** Dana, 1849 (p. 374)

Head rounded anteriorly; second antenna 3-segmented, stout; fourth metasome segment with sharp processes at posterior corners; caudal rami shorter; pelagic, at surface. ♂ ♀ **Corycaeus** Dana, 1845 (p. 354)

98. Second antenna 5-segmented, with a 2-segmented exopod attached to its second segment; first antenna 18-segmented; urosome 3-segmented, last 2 segments very short; invertebrate washings------------ ♀ **Cletopontius** Thompson and Scott, 1903

Second antenna 4-segmented, with a 1-segmented exopod attached to its second segment-- 99

Second antenna 3- or 4-segmented, without an exopod---------------- 101

99. Urosome 3-segmented, completely covered by last metasome segment; fifth leg fifteen times as long as wide, with hairy margins and 3 setae; oyster washings.
♀ **Lepeopsyllus** Thompson and Scott, 1903

Urosome entirely free dorsally; fifth leg as wide as long--------------- 100

100. Head wider than long; sucking tube reaching posterior margin of head; distal segment of first exopod with 2 spines and 4 setae; littoral, among algae------------- ♂ ♀ **Dyspontius** Thorell, 1859

Head longer than wide; sucking tube reaching posterior margin of metasome; distal segment, first exopod with 3 spines and 5 setae; dredged, 40 fathoms---- ♂ ♀ **Cryptopontius** Giesbrecht, 1899

101. Urosome fused into a single segment; head with ventral beak; fourth segment with sharp processes at the posterior corners; pelagic, at surface----------- ♂ ♀ **Corycella** Farran, 1911 (p. 361)[25]

Urosome 4-segmented in female, 5-segmented in male; no beak; all body segments except last 2 with epimeral plates, front ones crenate; parasitic----- ♂ ♀ **Pteropontius** Giesbrecht, 1895

102. Metasome inflated into a sphere; first and second antennae of equal length, the latter 2-segmented, with accessory claw; fifth legs lacking; gills of fishes-------- ♂ ♀ **Thersitina** Norman, 1905

Metasome cyclopoid, twice as long as wide; second antenna twice as long as first, 3-segmented, without accessory claw; fifth legs 1-segmented; pelagic------- ♂ ♀ **Limnoncaea** Kokubo, 1919

Metasome cylindrical or flattened; second antennae four to eight times as long as the first pair------------------------------- 103

103. Urosome 2-segmented in female, 3-segmented in male; second antenna seven or eight times as long as first pair; fifth leg a tiny knob with 1 seta (Lake Tanganyika).
♂ ♀ **Ergasiloides** G. O. Sars, 1909

Urosome 4-segmented in female, 5-segmented in male; second antenna four or five times as long as first pair; fifth leg 1-segmented, with 2 apical setae; gills of fishes.
♂ ♀ **Ergasilus** (part) Nordmann, 1832 (p. 375)

104. Fourth leg uniramose, 1-segmented; first antenna 5-segmented; second antenna 4-segmented, with no exopod; end segment with 3 unequal apical claws; parasitic on annelids.
♂ ♀ **Chonephilus** M. Sars, 1861

Fourth leg uniramose, 3-segmented; first antenna 18-segmented; second antenna 5-segmented, with 2-segmented exopod; end segment with 2 unequal end claws; washings of invertebrates---------- ♀ **Cletopontius** Thompson and Scott, 1903

105. Metasome with epimeral plates on one or more segments------------- 106

Metasome with no epimeral plates on any segment----------------- 108

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[25] *Corycella* was used by Leger for a genus of Protozoa in 1893. Blake has suggested in manuscript the name *Farranula* in place of it.

106. Last metasome segment expanded laterally, each pointed epimeral plate with a rigid seta; first antenna 6-segmented, with 4 apical setae; brackish water. ♀ **Microcancerilla** Norman and Brady, 1909
Head, first 2 metasome segments, and genital segment with bluntly rounded epimeral plates; first antenna 9-segmented, densely setose -- 107

107. Epimeral plate on genital segment with smooth lateral margin; end segment of first exopod with 3 spines and 5 setae; fifth leg a knob; on nudibranchs -------------- ♀ **Artotrogus** Boeck, 1859
Epimeral plate on genital segment with deep lateral notches; end segment of first exopod with 2 spines and 4 setae; fifth leg a lamina; pelagic, 190 fathoms----- ♀ **Dystrogus** Giesbrecht, 1899

108. Metasome elongated, subcylindrical, partly fused; first 2 pairs of legs anterior and juxtaposed, third pair at center of body; on annelids ------------------------- ♀ **Sabellacheres** M. Sars, 1861
Metasome truncated anteriorly, scarcely longer than wide; all 3 pairs of legs close together; fifth legs 2-segmented, with 2 setae; gills of fishes ------------ ♀ **Metopocatacoteinus** Hesse, 1871

109. Urosome of female 2-segmented; fifth leg 2-segmented, basal segment an oblique plate, with 1 outer seta, terminal segment oblong, without setae; in spine of *Calveria*. ♀ **Calverocheres**, new name[26]
Urosome of female 3-segmented, of male 4-segmented--------------- 110
Urosome of female 4-segmented, of male 5-segmented---------------- 112

110. First endopod modified for prehension, its segments fused, with sucking disks; metasome with epimeral plates; gills of *Callianassa*-------------- ♂ ♀ **Clausidium** Kossmann, 1875 (p. 344)
First endopod unmodified; metasome without epimeral plates-------- 111

111. First exopod 2-segmented, endopod 3-segmented, both widened; first antenna 4-segmented; second antenna 2-segmented, with 4 apical claws; eyes of fishes. ♂ ♀ **Pseudoeucanthus** Brian, 1906
Both rami of first leg 2-segmented, not widened; first antenna 17-segmented; second antenna 4-segmented, with apical setae; fresh water----- ♂ ♀ **Cyclops** (part) O. F. Müller, 1776 (p. 322)

112. First exopod 3-segmented, endopod 2-segmented; first antenna 7-segmented, its basal segment fused with head; second antenna 4-segmented, with 4 apical claws; littoral, among algae------------------------------------ ♀ **Assecula** Gurney, 1927
Both rami of first legs 2-segmented; first antenna 4-segmented; second antenna 3-segmented, tipped with 2 processes and a tuft of long setae; gills of fishes------------ ♀ **Phagus** Wilson, 1911
Both rami of first legs 1-segmented and much widened--------------- 113

113. First antenna 6-segmented; second antenna 3-segmented, with 4 apical claws and a ciliated process; fifth leg 1-segmented, elongate; mouth of fishes----- ♂ ♀ **Anchistrotos** Brian, 1906 (p. 384)
First antenna 4-segmented; second antenna 2-segmented, with 8 apical setae and no process; fifth leg 2-segmented, short and straight; gills of fish-------------------- ♀ **Irodes** Wilson, 1911

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[26] Hansen established in 1902 a new genus, *Echinocheres*, but this name had been preoccupied by Claus in 1889 for another copepod genus; compare 11 in this key.

114. Exopods and endopods each with the same number of segments in the first 4 pairs of legs, but unlike each other------------ 115

Exopods and endopods each with a different number of segments in the first 4 pairs of legs, some of them often lacking-------- 123

115. Exopods 3-segmented, endopods 2-segmented------------------------ 116

Exopods 2-segmented, endopods 3-segmented or 1-segmented--------- 121

Exopods 1-segmented, endopods 2-segmented or lacking-------------- 122

116. Urosome of female 4-segmented, of male 5-segmented--------------- 117

Urosome of female 3-segmented or 2-segmented, male unknown-------- 120

117. Second antenna 4-segmented, without an exopod, with apical setae; fifth legs lacking; caudal setae shorter than the caudal rami; in compound ascidian.

♂ ♀ **Ophthalmopachus** Hesse, 1866

Second antenna 3- or 2-segmented, no exopod; fifth legs present------- 118

118. Second antenna 2-segmented, with 5 apical setae; first antenna 11-segmented, sparsely setose; fifth leg a small knob with a single seta; pelagic, deep water----------- ♀ **Paroithona** Farran, 1908

Second antenna 3-segmented, armed with prehensile claws------------ 119

119. Second antenna with 1 stout apical claw; first antenna 7-segmented, sparsely setose; fifth leg a small knob with 2 unequal setae; in a holothurian--------- ♂ ♀ **Synapticola** Voigt, 1892

Second antenna with 2 stout apical claws; first antenna 6-segmented, densely setose; fifth leg laminate, 2-segmented, with marginal spines; in a holothurian.

♂ ♀ **Colaceutes** Hartmann, 1856

120. First antenna 6-segmented; second antenna 3-segmented, without an exopod, with 4 apical geniculate setae; fifth leg 2-segmented, with 4 setae; in echinoderms.

♀ **Synatiphilus** Canu and Cuénot, 1892

First antenna 13-segmented; second antenna 4-segmented, with 1-segmented exopod, and 8 straight apical setae; fifth leg 1-segmented, with 2 tiny setae; pelagic, moderate depths.

♀ **Oithonopsis** Brady, 1915

121. Endopods 3-segmented; genital segment and abdomen fused; fifth leg laminate, 1-segmented, with apical chela; caudal rami widely separated; on a serpulid------- ♀ **Bactropus** Gravier, 1912

Endopods 1-segmented; urosome segments separated; fifth leg a knob with 1 seta; second antenna 4-segmented, with 3 apical claws and no exopod; on an annelid.

♀ **Seridium** Giesbrecht, 1897

122. Endopods 2-segmented; first antenna 3-segmented; second antenna 3-segmented, with 1 seta; fifth leg a 1-segmented lamina, with 4 marginal setae; in brittle stars.

♂ ♀ **Enterognathus** Giesbrecht, 1900

Endopods lacking; first antenna 1-segmented; second antenna 1-segmented, papilliform; fifth legs lacking; fifth and genital segments fused; in an ophiurian.

♂ ♀ **Chordeumium** Stephensen, 1918

123. Exopod of first leg 1- or 2-segmented, endopod 2- or 3-segmented; exopods of second, third, and fourth legs 4-segmented, endopods 2- or 3-segmented; gills of fishes. ♂ ♀ **Bomolochus** (part) Nordmann, 1832 (p. 381)

Exopods of first 3 pairs of legs 2-segmented, endopods 1-segmented; fourth and fifth legs lacking; first antenna 6-segmented; second antenna 4-segmented; on annelids. ♀ **Pherma** Wilson, 1923

Rami of first and second legs alike, of third and fourth legs different ---------- 124

Rami all varying, some of them usually lacking ---------- 130

124. Rami of first and second legs 1-segmented ---------- 125

Rami of first and second legs 2- or 3-segmented ---------- 128

Exopods of first and second legs 3-segmented, endopods 2-segmented ---------- 129

125. Exopod of third legs 1-segmented, endopod and fourth legs lacking ---------- 126

Both rami of third and fourth legs lacking ---------- 127

126. Fifth leg 1-segmented, with 2 setae in female, 5 in male; second antenna with a stout apical claw; first antenna 6-segmented and sparsely setose; on brittle stars ----- ♂ ♀ **Cancerilla** Dalyell, 1851

Fifth and genital segments fused; fifth leg a stout spine; second antenna with 2 apical setae; first antenna 4-segmented, densely setose (Antarctic Ocean) - ♀ **Selenodiscus** Brady, 1910

127. First and second exopods each with 4 spines serrate on both margins, endopods with 3 such spines; second segment with pointed corners; pelagic, 260 fathoms ----- ♀ **Saphirella** T. Scott, 1894

First and second exopods each with 5 spines serrate on one margin, endopods with setae only; second segment with rounded corners; surface (New Zealand) ---- ♀ **Paurocope** Brady, 1899

128. Rami of first and second legs 3-segmented; third, fourth, and fifth legs lacking; first antenna 10-segmented; second antenna 3-segmented, with a 1-segmented exopod; mud, 5 fathoms ---------- ♂ **Entomolepis** Brady, 1899

Rami of first and second legs 2-segmented; exopods of third and fourth legs 2-segmented, endopods 1-segmented; second antenna 4-segmented, without an exopod; fins of fishes. ♂ ♀ **Tucca** Krøyer, 1837 (p. 379)

129. Exopod of third leg 2-segmented, endopod, both rami of fourth leg, and fifth leg lacking; a sucking disk in front of mouth of female; on annelids ---------- ♂ ♀ **Eunicicola** Kurz, 1877

Both rami of third leg and exopod of fourth leg 1-segmented; endopod of fourth leg and fifth leg lacking; no sucking disk in female; on annelids ---------- ♀ **Clausia** Claparéde, 1863

130. One or both rami present in each of first 4 pairs of legs ---------- 131

Both rami lacking in one or more of first 4 pairs of legs ---------- 132

131. Rami of first legs 1-segmented, of second and third legs 2-segmented; exopod of fourth leg 2-segmented, endopod lacking; fifth leg lamellar and unarmed; invertebrate washings ---------- ♂ ♀ **Stephopontius** Thompson and Scott, 1903

Rami of first leg and endopod of third leg 2-segmented; rami of second leg and exopod of third leg 3-segmented; fourth exopod 1-segmented, endopod lacking; dredged, 40 fathoms. ♂ ♀ **Parartotrogus** T. and A. Scott, 1893

132. All 5 pairs of legs lacking; first antennae 1-segmented, bipartite at tip, unarmed; second antennae and maxillipeds lacking; 1 pair of maxillae; on an ophiurid. ♂ ♀ **Arthrochordeumium** Stephensen, 1918

First 3 pairs of legs present and uniramose, the others lacking-------- 133

133. First and third legs 4-segmented, second pair 3-segmented, with an apical disk; genital segment produced laterally; egg cases turned forward and out; on annelids. ♂ ♀ **Selioides** Levinsen, 1878

First and third legs 5-segmented, second pair 2-segmented, with 2 apical spines; genital segment not produced; egg cases lobed on their outer margin; on annelids--- ♀ **Selius** Krøyer, 1837

KEY TO THE GENERA OF THE SUBORDER NOTODELPHYOIDA

(The segmentation of the first 4 pairs of legs and the structure of the fifth legs and second antennae furnish the best means of identification.)

1. First 4 pairs of legs biramose, rami 3-segmented------------------------ 2

First 4 pairs of legs biramose, rami 2-segmented------------------------ 15

First 4 pairs of legs biramose, rami 1-segmented------------------------ 18

First 4 pairs of legs biramose, rami not uniformly segmented------------ 29

First 4 pairs of legs uniramose, some of them often lacking-------------- 37

First legs biramose, 3 following pairs uniramose, rami 1-segmented; fifth legs laminate, 1-segmented; first antennae 8-segmented; second antennae 3-segmented; in ascidians. ♀ **Enterocolides** Chatton and Harant, 1922

2. Fifth legs biramose, rami of equal length, 1-segmented, exopod conical, with a single long apical seta, endopod laminate and unarmed; in ascidians---------- ♂ **Paranotodelphys** Schellenberg, 1921

Fifth legs uniramose and 2-segmented------------------------------------- 3

Fifth legs uniramose and 1-segmented, or reduced to mere knobs---------- 8

Fifth legs replaced by setae, or wholly lacking------------------------- 11

3. Caudal rami modified for prehension, armed with claws------------------ 4

Caudal rami not prehensile, armed with plumose setae-------------------- 5

Caudal rami not prehensile, naked, without claws or setae--------------- 7

4. Body compressed laterally; brood pouch boldly arched dorsally; caudal rami curved downward, each armed with an apical claw; in ascidians------------------- ♂ ♀ **Pachypygus** G. O. Sars, 1921

Body cylindrical; brood pouch exceptionally long and flatly arched; caudal rami laminate, with stout clawlike spines; in ascidians----------------------------------- ♀ **Botachus** Thorell, 1859

5. Distal segment of fifth leg four times as long as wide; caudal rami six to eight times as long as wide; metasome segments all the same width; in ascidians-------- ♂ ♀ **Doropygopsis** G. O. Sars, 1921

Distal segment of fifth leg as wide as long, with 1 apical seta------------ 6

6. Metasome fusiform; caudal rami three times as long as wide, apical setae five times as long as rami; urosome half as long as metasome; dredged, 20 fathoms------------ ♂ **Agnathaner** Canu, 1892

Metasome obovate; caudal rami four times as long as wide, or more; setae no longer than rami; urosome one-fourth as long as metasome; in ascidians------- ♂ ♀ **Notodelphys** Allman, 1847 (p. 386)

7. Brood pouch large and gibbous; caudal rami long, with minute apical hairs; distal segment of fifth leg twice as long as wide; in ascidians------------------ ♂♀ **Doropygus** Thorell, 1859 (p. 387)
   Brood pouch small, not gibbous; caudal rami short, unarmed; distal segment of fifth leg as wide as long, with 1 apical seta; in ascidians--------------------- ♂♀ **Doropygella** G. O. Sars, 1921
8. Males, urosome 5-segmented; first endopods longer than the exopods; first antennae 8-segmented; second antennae 3-segmented, with apical claw; in ascidians------ ♂ **Enterocola** Beneden, 1860
   Males, urosome 4-segmented; first exopods longer than the endopods--- 9
   Females, urosome 4-segmented; eggs carried in a brood pouch----------- 10
9. First antennae 6-segmented; caudal rami four times as long as wide, each with 4 apical and 1 outer setae; no spines on ventral surface; in ascidians---------------------- ♂ **Ascidicola** Thorell, 1859
   First antennae 8-segmented; caudal rami twice as long as wide, their ventral surface spiny; longest seta as long as ramus is wide; in ascidians------------------------ ♂ **Bonnierilla** Canu, 1891
10. Brood pouch covering last 4 metasome segments, not extending farther backward and bluntly rounded at its posterior end; in ascidians------------------------------ ♀ **Bonnierilla** Canu, 1891
    Brood pouch confined to fifth metasome segment, but extending beyond tip of caudal rami and sharply pointed; in ascidians. ♀ **Goniodelphys** Buchholtz, 1869
11. Males, urosome 4-segmented; first antennae 6-segmented; caudal rami four times as long as wide, each with 4 apical and 1 outer plumose setae; in ascidians---- ♂ **Ascidicola** Thorell, 1859
    Males, urosome 2-segmented; first antennae 7-segmented; caudal rami fingerlike, twice as long as wide, each with a single apical seta; in ascidians--------- ♂ **Enteropsis** Aurivillius, 1885
    Females, urosome 5-segmented; first antennae 9-segmented; caudal rami four times as long as wide, each with 4 terminal and 1 outer setae; in sediment---- ♀ **Pseudonotodelphys** Gurney, 1927
    Females, urosome 4-segmented; eggs carried in a brood pouch--------- 12
12. Second antennae 3-segmented, tipped with a weak claw and 2 or 3 setae-- 13
    Second antennae 2-segmented, tipped with a single apical claw---------- 14
13. Brood pouch ovoid; caudal rami slender and twice as long as the urosome, tipped with small hairs; fifth legs wholly lacking; in ascidians----------- ♀ **Notodelphyopsis** Schellenberg, 1921
    Brood pouch wider than long; caudal rami no longer than anal segment, with 2 apical claws; each fifth leg replaced by 2 setae; in ascidians-------------------- ♀ **Hypogastrion** Wilson, 1924
14. First antennae 9-segmented; caudal rami as long as last 2 urosome segments, or longer; all 4 pairs of swimming legs symmetrical; in ascidians------ ♀ **Paranotodelphys** Schellenberg, 1921
    First antennae 8-segmented; caudal rami no longer than anal segment; first pair of legs symmetrical, second, third, and fourth asymmetrical; in ascidians----------- ♀ **Bonnierilla** Canu, 1891
15. Head with lateral wings; fifth legs 2-segmented; second antennae in female 3-segmented, with an apical claw, in male 2-segmented and chelate; in ascidians. ♂♀ **Lonchidiopsis** Vanhöffen, 1917
    Head without lateral wings; fifth legs 1-segmented, or lacking----------- 16

16. Males, urosome not segmented; first antennae 7-segmented; second antennae 4-segmented and nonprehensile; fifth legs wholly lacking; on mollusks------------ ♂ **Enteropsis** Aurivillius, 1885

Females, urosome 4-segmented; eggs carried in external ovisacs--------- 17

17. Metasome distinctly segmented; caudal rami slightly divergent, with apical setae; fifth legs laminate, covering the ovisacs; in ascidians------------------------------- ♀ **Ascidicola** Thorell, 1859

Head separated, rest of metasome fused; caudal rami turned outward, with claws; fifth legs conical, not covering ovisacs; in ascidians------------------- ♀ **Botryllophilus** Hesse, 1864 (p. 392)

18. Second antennae 3-segmented, armed with claws or setae-------------- 19

Second antennae 2-segmented, armed with spines or claws-------------- 23

Second antennae 1-segmented and unarmed------------------------ 28

19. A single spherical ovisac on dorsal surface of urosome; fifth legs conical, widely separated and not covering ovisac; in ascidians. ♀ **Botryllophilus** Hesse, 1864 (p. 392)

A single flattened ovisac on dorsal surface of urosome, covered at its base by the partially fused laminate fifth legs----------------- 20

Two external ovisacs attached to sides of genital segment; fifth legs entirely separate on sides of fifth segment--------------------- 21

Two external ovisacs; fifth legs entirely lacking---------------------- 22

20. Urosome 5-segmented; caudal rami obliquely divergent; first antennae 4-segmented; leg endopods laminate, with apical and outer spines; in ascidians---- ♂ ♀ **Schizoproctus** Aurivillius, 1885

Urosome 3-segmented; caudal rami at right angles to body axis, first antennae 6-segmented; leg endopods conical, with long apical setae; in ascidians-------------- ♀ **Pteropygus** G. O. Sars. 1921

21. Fifth legs conical lobes, widely separated; ovisacs cylindrical, longer than body; end segment of second antenna minutely denticulate; in ascidians----------------- ♀ **Cryptopodus** Hesse, 1865

Fifth legs curved lamellae, meeting dorsally; ovisacs club-shaped, shorter than body; end segment of second antennae setose; in ascidians------------------- ♀ **Enterocola** Beneden, 1860

22. Mandibles 1-segmented processes of medium size, with 3 setae; first maxillae biramose and well developed, with several setae; in ascidians------ ♀ **Haplostomides** Chatton and Harant, 1924

Mandibles mere knobs, each with 1 or 2 setae; first maxillae lacking; exopods of swimming legs with terminal and several outer claws; in ascidians---------------- ♀ **Haplostoma** Canu, 1886

Mandibles and maxillae both lacking; exopods of swimming legs each with one terminal claw only; no caudal rami; in ascidians---------------- ♀ **Haplosaccus** Chatton and Harant, 1924

23. Fifth legs present and biramose like the other pairs; first antennae 1-segmented; urosome with lateral wings; eggs in 2 ovisacs; in ascidians------------------- ♀ **Hypnoticus** Wilson, 1924

Fifth legs present, uniramose and 1-segmented---------------------- 24

Fifth legs replaced by folds of skin; first antennae laminate, 1-segmented, unarmed; urosome without wings; eggs in 2 ovisacs; in ascidians------------------- ♀ **Ophioseides** Hesse, 1864

Fifth legs entirely lacking------------------------------------- 27

24. Head separated from thorax by a short neck; sides of metasome deeply incised; fifth legs laminate, three times as long as wide; in ascidians ---------------------------- ♀ **Lygephilus** Hesse, 1865

Head passing insensibly into thorax without a neck; sides of metasome smooth and not incised ---------------------------------- 25

25. Fifth legs curved laminae, meeting dorsally and covering bases of ovisacs; second antennae flattened laminae, 1- or 2-segmented; in ascidians --------------- ♀ **Enterocola** Beneden, 1860

Fifth legs straight laminae, not meeting dorsally nor reaching the ovisacs; each 3-lobed with 3 setae; second antennae cylindrical; in ascidians -- ♀ **Haplostomella** Chatton and Harant, 1924

Fifth legs fingerform, conical, or wartlike, not meeting dorsally --------- 26

26. Body often unsegmented; rami of legs equal, exopods lanceolate, with apical claw and outer teeth; endopods laminate, unarmed; in ascidians ------------------- ♀ **Tranestoma** Wilson, 1924

Body always segmented; endopods lanceolate, with inner teeth and much longer than the laminate and unarmed exopods; in ascidians --------------------------- ♀ **Cryptopodus** Hesse, 1865

27. Head separated from thorax; latter fused with urosome and not segmented; body cavity used as an incubatory chamber; in ascidians ---------------------- ♀ **Scolecimorpha** G. O. Sars, 1926

Head fused with first segment; body more or less segmented, with the usual dorsal brood pouch; cuticle hairy at both ends of body; in ascidians ------- ♀ **Brementia** Chatton and Brement, 1915

28. Exopods of first 4 pairs of legs 1-segmented, with apical claws; endopods circular pads, with papillae; body distinctly segmented; in ascidians ------------------ ♂ ♀ **Zanclopus** Calman, 1908

Exopods of first 4 pairs of legs spiniform, endopods finger processes, unarmed; metasome segmented, urosome fused into 1 segment; in ascidians ------- ♀ **Lequerrea** Chatton and Harant, 1924

29. Rami of first 3 pairs of legs 1-segmented, fourth and fifth pairs lacking; first antennae 6-segmented; second antennae 3-segmented, 5 setae; on annelids -------- ♀ **Chelonidiformis** Hesse, 1869

Rami of first 3 pairs of legs 3-segmented, fourth pair different --------- 30

Rami of second, third, and fourth legs 3-segmented, first pair different -- 31

Exopods and endopods segmented differently, some often lacking -- 32

30. Fourth endopod 2-segmented, exopod 3-segmented; fifth legs reduced to spines; posterior corners of head with spines; a brood sack; in ascidians ----------------- ♀ **Doroixys** Kerschner, 1879

Fourth endopod 2-segmented, exopod 1- or 3-segmented; fifth legs cornuate and curved; head without spines; eggs in 2 external ovisacs; in ascidians ------- ♀ **Blakeanus** Wilson, 1921 (p. 391)

31. Males only; rami of first legs 2-segmented; first antennae 6-segmented; second antennae prehensile, 2-segmented; fifth legs setigerous stumps; in ascidians ------- ♂ **Ophioseides** Hesse, 1864

Both sexes; first endopod 2-segmented, exopod 3-segmented; first antennae 7-segmented; second antennae 3-segmented, prehensile; fifth legs 2-segmented; in ascidians.
♂ ♀ **Notopterophoroides** Schellenberg, 1921

32. Exopods of first 4 pairs of legs 3-segmented; first endopod 1- or 2-segmented; second, third, and fourth endopods 2- or 3-segmented; in ascidians-------- ♂ **Botryllophilus** Hesse, 1864 (p. 392)
Exopods of first 4 pairs of legs 3-segmented, endopods 2-segmented --------- 33
Exopods of first 4 pairs of legs 2-segmented, endopods 1-segmented --------- 34
Odd combination of segmentation and absence of rami----------------- 35

33. Metasome segments of female produced into dorsal and lateral processes; first antennae 8- or 9-segmented; caudal rami unciform; in ascidians------------- ♂ ♀ **Notopterophorus** Costa, 1829
Metasome segments without processes, but with epimeral plates; first antennae 12-segmented; caudal rami normal, with apical setae; in ascidians------------ ♀ **Platythorax** Hesse, 1866

34. Brood pouch covering entire thorax; urosome reduced to a single segment; first and second antennae 3-segmented, nonprehensile; in ascidians---------------- ♀ **Buprorus** Thorell, 1859
Brood pouch not covering first segment; urosome 5-segmented; first antennae 2-segmented; second antennae 3-segmented; fifth legs squamate; in ascidians------ ♀ **Campopera** Schellenberg, 1921

35. Exopods of first 4 pairs of legs 3-segmented; first endopod 3-segmented, second and third endopods 4-segmented, fourth endopod 2-segmented; last 3 no setae; in ascidians.
♀ **Gunentophorus** Costa, 1840
Exopods of first and second legs 3-segmented, endopods 1-segmented; third legs uniramose, 2-segmented; fourth and fifth legs lacking; second antennae 4-segmented; on annelids.
♀ **Gastrodelphys** Graeffe, 1883
Rami of first and second legs 1-segmented, other pairs reduced or lacking--- 36

36. Third legs each reduced to a tiny papilla, fourth and fifth legs lacking; first antennae 3-segmented; second antennae 3-segmented, with 4 claws; on annelids---- ♀ **Nereicola** Keferstein, 1863
Third, fourth, and fifth legs lacking; first antennae unsegmented stumps, with short spines; second antennae in female 1-segmented, in male 3-segmented; in *Balanoglossus*--- ♂ ♀ **Ive** Mayer, 1879

37. First 4 pairs of legs present, fifth pair lacking------------------------- 38
First 2 or 3 pairs of legs present, the others lacking------------------ 44
All 5 pairs of legs lacking--- 46

38. First 4 pairs of legs 4-segmented; first and second antennae each 3-segmented, the latter with 2 small apical claws; caudal rami without setae; in ascidians------------ ♀ **Narcodina** Wilson, 1924
First 4 pairs of legs with less than 4 segments------------------------- 39

39. Body cylindrical; legs not sheathed in a basal capsule; urosome not segmented, metasome more or less distinctly segmented---------- 40
Body moderately depressed; legs sheathed in a basal capsule; both metasome and urosome rather distinctly segmented------------ 42

40. Anus dorsal, in groove between metasome and urosome; first and second antennae 2-segmented; legs truncated cones, 2-segmented, 2 end claws; in ascidians----- ♀ **Mychophilus** Hesse, 1865
Anus in normal position, terminal; urosome shorter than metasome; legs conical, 1-segmented or 2-segmented; second antennae prehensile; in ascidians------ ♀ **Enteropsis** Aurivillius, 1885
Anus in normal position, terminal or terminodorsal; urosome longer than metasome--- 41

41. Legs 1-segmented, flattened laterally, triangular, each with an apical claw; caudal rami conical, partly fused at their bases; in acidians ---------------------------------- ♀ **Aplopodus** Hesse, 1869
    Legs 2-segmented, retractile, not flattened, each with an apical spine; caudal rami sharply pointed, not fused at their bases; in ascidians ---------------------------------- ♀ **Adranesius** Hesse, 1865
42. Metasome nine times as long as wide, segmentation indistinct; first 4 pairs of legs 2-segmented, chelate; caudal rami and fifth legs lacking; in ascidians ---------------------- ♀ **Podolabis** Hesse, 1864
    Metasome scarcely three times as long as wide, distinctly segmented; fifth legs lacking; caudal rami present ---------------------- 43
43. Urosome 3-segmented; caudal rami conical, clawlike, turned outward at right angles; legs with several small apical spines; in ascidians ---------------------------------- ♀ **Polyoon** Hesse, 1878 [27]
    Urosome 1-segmented; caudal rami laminate and triangular, fused at their bases, the tips divergent; legs with 1 stout apical claw; in ascidians ---------------- ♀ **Pachynesthus** Hesse, 1878 [27]
44. Three pairs of 1-segmented legs present; first antennae 7-segmented; second antennae 3-segmented, with 4 or 5 unequal apical setae, no claws; on annelids ---- ♀ **Anomopsyllus** G. O. Sars, 1921
    Only 2 pairs of 1-segmented legs present ---------------------------------- 45
45. Second antennae 3- or 4-segmented, each with a single apical claw; caudal rami short, somewhat divergent and tipped with spines; in alcyonarians -------------- ♀ **Lamippe** Bruzelius, 1858
    Second antennae 1-segmented, with an apical claw; caudal rami half as long as entire body, conical and unarmed; cuticle papillose; in alcyonarians ----------- ♀ **Linaresia** Zulueta, 1908
    Second antennae 1-segmented, each with a single apical claw; caudal rami short stumps, each with 3 fleshy papillae but without setae; in alcyonarians ------------- ♀ **Isidicola** Gravier, 1914
46. Metasome and urosome indistinguishably fused, without segmentation; no appendages except rudiments of the first antennae; dredged, 8 fathoms (see p. 621) -- ♀ **Jeanella** T. Scott, 1904
    Metasome and urosome distinctly separated, segmented or not ---------- 47
47. Two pairs of antennae and 3 pairs of mouth parts present -------------- 48
    Neither antennae nor mouth parts present ---------------------------- 49
48. First antennae 5-segmented, setiferous; second antennae 3-segmented, prehensile; urosome 2-segmented; no foldings or invagination of body; on annelids -------- ♀ **Nereicola** Keferstein, 1863
    First antennae 4-segmented, hairy; second antennae 2-segmented, prehensile; urosome 1-segmented, invaginate into metasome; body folded ventrally; in ascidians.
    ♀ **Ooneides** Chatton and Brément, 1915
49. Metasome elliptical and distinctly segmented; urosome 3-lobed, not segmented; body without lateral processes; head fused with thorax; on annelids ---------- ♂♀ **Melinnacheres** M. Sars, 1870
    Metasome broadly ovate, not segmented; urosome 2-segmented; head separated from thorax; latter with 4 pairs of pointed lateral processes; on nudibranchs- ♀ **Lomanoticola** T. and A. Scott, 1895

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[27] Hesse claimed that the first antennae of *Polyoon* and *Pachynesthus* were biramose, both exopods and endopods distinctly segmented.

KEY TO THE GENERA OF THE SUBORDER MONSTRILLOIDA

(Owing to the absence of second antennae and mouth parts and the similarity in structure of the first antennae and swimming legs, distinctions in this group are based on the form and segmentation of the body and the armature of the caudal rami)

1. Body cyclopoid, metasome much wider than urosome; fourth and fifth legs rudimentary and of similar structure; first antennae 9-segmented, setose; 60 fathoms---- ♀ **Thespesiopsyllus,** new name [28]

   Body elongate, cylindrical, urosome nearly as wide as metasome; fourth legs as well developed as first 3 pairs; first antennae 4-segmented, or less-- 2

2. Urosome of female 3-segmented, of male 4-segmented------------------- 3

   Urosome of female 2-segmented, of male 3-segmented------------------- 4

3. Oral tubule near the center of the ventral surface of the cephalothorax; fifth legs present in male; caudal rami with 5 or 6 setae; surface tow---------------- ♂ ♀ **Monstrilla** Dana, 1848 (p. 393)

   Oral tubule placed far forward near anterior margin; fifth legs absent in male; caudal rami with 2 apical and 2 lateral setae; surface tow---------------------- ♂ ♀ **Monstrillopsis** G. O. Sars, 1921

4. Caudal rami club-shaped, each with 3 setae in female, 4 in male; oral tubule at anterior margin; fourth legs in female shortened; surface tow---------------- ♂ ♀ **Cymbasoma** Thompson, 1888 (p. 395)

   Caudal rami linear, each with 5 setae in female; oral tubule removed from anterior margin; fourth legs as long as other pairs; surface tow----------------------- ♀ **Thaumaleus** Krøyer, 1849

KEY TO THE GENERA OF THE SUBORDER CALIGOIDA

(Important characters are still furnished by the structure of the 5 pairs of legs and the second antennae, but they are largely supplemented by the relative size, shape, and armature of the various body regions)

1. Entire body more or less distinctly segmented and depressed; fourth segment narrowed; genital segment enlarged, often to the size of the carapace--- 2

   Body more or less distinctly segmented and cylindrical; fourth segment as wide as third; genital segment usually smaller, rarely enlarged-- 47

   Body cylindrical but not segmented; head and neck distinct, with horns or processes for attachment; rest of body fused into a trunk-- 68

2. Three anterior segments fused with the head; first or fourth legs, or both pairs, often uniramose-- 3

   Two anterior thoracic segments fused with head; first 4 pairs of legs biramose; no dorsal plates; genital segment never as large as carapace; outside of fishes------- ♂ ♀ **Trebius** Krøyer, 1838 (p. 413)

   First segment only fused with head; first 4 pairs of legs biramose (except *Pholidopus*); females with, males without, dorsal plates--------- 23

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[28] Sars proposed the name *Thaumatopsyllus* for this genus, but that name was published by T. Scott in 1894 as a synonym of *Aegisthus*.

3. Both first and fourth legs uniramose, second and third pairs biramose ---------- 4

First legs only uniramose, second, third, and fourth pairs biramose ---------- 18

Fourth legs only uniramose, first, second, and third pairs biramose ---------- 19

First 4 pairs of legs biramose; fourth segment with dorsal plates ---------- 21

4. Fourth, fifth, and genital segments fused, with a single dorsal plate, and a smooth conical process near each posterior corner; mouth of fishes ---------- ♀ **Dentigryps** Wilson, 1913

Fourth segment separated from fifth, with paired dorsal plates, overlapping the genital segment in female, rudimentary in male ---------- 5

Fourth segment separated from fifth, without dorsal plates; genital segment with or without posterior processes ---------- 6

5. Frontal plates with lunules; claws on first legs simple; genital segment with lobes and rudimentary legs at its posterior corners; outside of fishes ---------- ♂ ♀ **Tuxophorus** Wilson, 1908

Frontal plates without lunules; claws on first legs 3-pronged; genital segment with horny toothed processes at its corners; outside of fishes --- ♂ ♀ **Gloiopotes** Steenstrup and Lütken, 1861 (p. 415)

6. Frontal plates with lunules; maxillae simple, spinelike ---------- 7

Frontal plates without lunules; maxillae bifurcate or simple ---------- 14

7. Genital segment simple, without processes or wings ---------- 8

Genital segment with posterior processes as long as the abdomen ---------- 13

Genital segment surrounded by a 2-lobed membranous wing; abdomen also with a wing on either side, curling around the ovisacs; gill cavity of fishes - ♀ **Parapetalus** Steenstrup and Lütken, 1861

8. Fourth segment produced into a long neck; genital segment many times larger than carapace; fourth legs 2-segmented; caudal rami filiform; gill cavity of fishes ---------- ♀ **Echetus** Krøyer, 1863

Fourth segment short; genital segment usually much smaller, rarely a little larger than the carapace and depressed ---------- 9

9. Furca and maxillary hooks both lacking ---------- 10

Furca and maxillary hooks both present ---------- 11

10. Genital segment shorter and narrower than the carapace; abdomen one-third the length of genital segment; caudal rami wider than long; mantle of *Nautilus* --- ♂ ♀ **Anchicaligus** Stebbing, 1900

Genital segment longer than carapace; abdomen longer than rest of body; caudal rami three times as long as wide, with 4 to 6 setae; gill cavity of fishes ------ ♂ ♀ **Sciaenophilus** Beneden, 1852

11. Fourth legs rudimentary, 1-segmented; genital segment much wider than long; abdomen with only 1 segment; caudal rami large and stout; gill cavity of fishes --- ♂ ♀ **Pseudocaligus** A. Scott, 1901

Fourth legs normally developed, with 3 or 4 segments ---------- 12

12. Males only; 3 terminal segments of fourth legs solidly fused and armed with spines coarsely flattened and broadly winged; gill cavity of fishes - ♂ **Parapetalus** Steenstrup and Lütken, 1861

Both sexes; 3 terminal segments of fourth legs loosely fused and armed with setae or spines neither flattened nor winged; everywhere on fishes ---------- ♂ ♀ **Caligus** Müller, 1785 (p. 397)

13. Four of these processes, 2 dorsal, 2 ventral; fourth segment small, of normal length; abdomen club-shaped and made up of 2 segments; gills of fishes- ♀ **Synestius** Steenstrup and Lütken, 1861

Two dorsal processes only; fourth segment produced into a long neck; abdomen same diameter throughout and 1-segmented; mouth of fishes----------- ♀ **Caligodes** Heller, 1865 (p. 408)

14. Genital segment without plates or processes; maxillae divided or simple; furca present-- 15

Genital segment without plates, but often with processes; maxillae simple; furca lacking-- 17

Genital segment covered with a fused dorsal plate, overlapping the abdomen; maxillae divided; furca well developed; outside of fishes-------------------------------- ♂ ♀ **Homoiotes** Wilson, 1905

15. Carapace deeply incised on frontal margin, 2 sides folded together on midline; fourth legs with 3 segments only; gills of fishes---------------------------------- ♀ **Hermilius** Heller, 1865

Carapace depressed, but neither incised nor folded-------------------- 16

16. First maxillae divided; abdomen normally developed, with caudal rami attached to its posterior margin; fourth legs 4-segmented; outside of fishes.
♂ ♀ **Lepeophtheirus** Nordmann, 1832 (p. 409)

First maxillae simple; abdomen wanting; caudal rami attached to ventral surface of genital segment; fourth legs with only 3 segments; gills of fishes------------------ ♀ **Anuretes** Heller, 1865

17. Genital segment with 2 posterior processes longer than the segment itself; abdomen five times as long as wide and concealed; gills of fishes------------------ ♀ **Diphyllogaster** Brian, 1899

Genital segment without processes; maxillae mere rudiments; abdomen only twice as long as wide, 2-segmented, wholly visible; mouth of fishes------------------- ♂ ♀ **Abasia** Wilson, 1908

18. Both rami of fourth legs 3-segmented; abdomen longer than genital segment; fourth segment without dorsal plates; maxillae bifurcate; outside of fishes-------------- ♀ **Calistes** Dana, 1849

Fourth exopod 3-segmented, endopod 2-segmented; abdomen shorter than genital segment; fourth segment with dorsal plates; maxillae simple; gills of fishes-------- ♀ **Caligeria** Dana, 1849

19. Frontal plates with lunules; maxillary hooks and furca both present; basal abdomen segment lobed in female, not lobed in male; outside of fishes---------------------- ♂ ♀ **Midias** Wilson, 1911

No lunules, maxillary hooks, or furca; basal abdomen segment lobed in female, not lobed in male; exopods with horny processes; outside of sharks-------- ♂ ♀ **Alebion** Krøyer, 1863 (p. 418)

Frontal plates without lunules; abdomen without lobes---------------- 20

20. No maxillary hooks or furca; fourth segment without dorsal plates; genital segment with 2 ventral horny processes; maxillae divided; outside of fishes------------- ♂ ♀ **Calina** Beneden, 1892

Maxillary hooks and furca present; fourth segment with rudiments of dorsal plates; genital segment without processes; maxillae simple; mouth of fishes-------- ♂ ♀ **Paralebion** Wilson, 1911

21. Both rami of fourth legs 2-segmented; furca present; genital and basal abdominal segments without lobes or leg rudiments; in surface tow------------ ♂ ♀ **Dysgamus** Steenstrup and Lütken, 1861

Fourth exopods 3-segmented, endopods 2-segmented; genital and basal abdominal segments with lobes in female, without them in male--- 22

22. Abdomen much shorter than genital segment, its 2 segments about the same length; genital segment less than half as wide as carapace; outside of fishes- ♂ ♀ **Elytrophora** Gerstaecker, 1853 (p. 416)
Abdomen twice as long as genital segment, its basal segment 10 times as long as terminal segment; genital segment wider than carapace; gill cavity of fishes- ♀ **Euryphorus** Milne Edwards, 1840

23. First legs uniramose, others biramose; 2 pairs of dorsal thoracic plates, 1 on fused second and third segment, 1 on fourth segment; outside of sharks---------------- ♀ **Pholidopus** Wilson, 1907
All 4 pairs of legs biramose; thorax with or without dorsal plates---------- 24

24. One to four pairs of dorsal plates; abdomen 1-segmented and wholly concealed in dorsal view------------------------------------ 25
No dorsal plates; abdomen 1- or 2-segmented and wholly visible in dorsal view; males only--------------------------------------- 39

25. Rami of first 4 pairs of legs with same number of segments, and all of them armed with plumose setae or spines, or both------------- 26
Rami of first 4 pairs of legs differing in number of segments, some or all of them destitute of setae and spines------------------- 27

26. Rami all 3-segmented; 4 pairs of dorsal plates, first and third pairs median, second and fourth lateral; second pair widely separated, fourth fused; outside of shark---- ♀ **Lepimacrus** Hesse, 1883
Rami all 2-segmented; 1 pair of dorsal plates on fourth segment in female, none in male; abdomen 1-segmented; caudal rami very large, setae short; outside of shark--- ♂ ♀ **Demoleus** Heller, 1865

27. Rami of first 3 pairs of legs 2-segmented, of fourth pair 1-segmented--- 28
Rami of first 2 pairs 2-segmented, of third and fourth pairs 1-segmented--- 35
The 2 rami of each pair alike, but not combined as above-------------- 36
The 2 rami in some pairs alike, in others different-------------------- 38

28. An extra segment attached as a median lobe to the posterior sinus of the genital segment; caudal rami horny, without setae--------- 29
No extra segment; caudal rami normal and armed with setae----------- 30

29. Second, third, and fourth segments each with dorso-lateral plates, the 3 pairs alike in form and position; no adhesion pads on thorax; fins of sharks-------- ♀ **Parapandarus** Wilson, 1924 (p. 439)
Second segment with a pair of lateral plates, third and fourth segments with dorsal plates, the 3 pairs unlike; 4 pairs of adhesion pads; fins of sharks--------- ♀ **Pandarus** Leach, 1816 (p. 432)

30. A single pair of dorsal plates on fourth thoracic segment--------------- 31
Two pairs of dorsal plates, on third and fourth segments, latter covering urosome ------------- ♂ **Cecrops** Leach, 1816 (p. 441)
Two pairs of dorsal plates, second pair on genital segment------------- 32
Three pairs of dorsal plates, third pair on genital segment-------------- 34

31. Second and third segments with 1 pair of lateral lobes; the plates on fourth segment fused at base; genital segment longer than wide; throat of sharks----------- ♂ ♀ **Nesippus** Heller, 1865 (p. 438)
Second and third segments separated, with 2 pairs of lateral lobes; plates on fourth segment also separated; genital segment wider than long; gills of sharks--------- ♀ **Prosaetes** Wilson, 1907

32. Dorsal plates on fourth segment covering less than one-third of genital segment; margins of carapace and plates smooth, without denticles; outside of fishes---------- ♀ **Luetkenia** Claus, 1864
Dorsal plates on fourth segment covering two-thirds of genital segment; margins of carapace and plates finely dentate-------------- 33

33. Males only; abdomen visible in dorsal view; second and third segments forming waist between head and fourth segment; fourth rami lamellar; outside of fishes.
♂ **Orthagoriscicola** Poche, 1902 (p. 443)

Both sexes; abdomen entirely concealed in dorsal view; second and third segments as wide as fourth, no waist; fourth rami narrow conical; outside of fishes.
♂ ♀ **Philorthragoriscus** Horst, 1897 (p. 444)

34. Abdomen as large as genital segment, both with broad lateral wings between which the long egg strings are coiled and concealed; gills of fishes------------- ♀ **Cecrops** Leach, 1816 (p. 441)

Abdomen smaller than genital segment, both without wings; egg strings long but entirely visible, and neither coiled nor convoluted; outside of sharks------------- ♀ **Achtheinus** Wilson, 1908

35. Four pairs of dorsal plates, the halves of first 3 pairs entirely separated, of fourth pair fused, with a posterior sinus; fins of sharks--------- ♀ **Perissopus** Steenstrup and Lütken, 1861 (p. 424)

Two pairs of dorsal plates, partly fused with serrate margins; first pair with posterior sinus, second pair overlapping on midline; outside of fishes--- ♀ **Orthagoriscicola** Poche, 1902 (p. 443)

36. Rami of first, second, and fourth legs 1-segmented; of third legs 2-segmented; 3 pairs of dorsal plates, each wider than the carapace; outside of sharks-------- ♀ **Phyllothyreus** Norman, 1903

Rami of first legs 2-segmented, of second and third legs 3-segmented--- 37

37. Fourth segment without dorsal plates; rami of fourth legs 3-segmented; leg rudiments on genital segment; urosome shorter than metasome; gills of fishes------- ♂ ♀ **Dissonus** Wilson, 1906

Fourth segment with dorsal plates; rami of fourth legs laminate, 1-segmented; no leg rudiments on genital segment; urosome longer than metasome; outside of sharks.
♀ **Dinematura** Burmeister, 1833 (p. 430)

38. Exopod of first legs 1-segmented, endopod 2-segmented; rami of second and third legs 2-segmented, of fourth legs 1-segmented; 3 pairs of dorsal plates; gill cavity of sharks.
♀ **Gangliopus** Gerstaecker, 1854

Rami of first legs 2-segmented, second and third exopods 3-segmented, endopods 2-segmented; fourth rami 1-segmented in female, in male exopod 3-segmented, endopod 2-segmented; outside of sharks.
♂ ♀ **Echthrogaleus** Steenstrup and Lütken, 1861 (p. 426)

39. Rami of first 4 pairs of legs 2-segmented---------------------------- 40

Rami of first 3 pairs of legs 2-segmented, fourth pair 1-segmented-- 43

One or both rami of second and third legs 3-segmented, the others 2-segmented-- 46

40. Abdomen 1-segmented; caudal rami small and semicircular; maxillipeds moderately swollen, with chelate claw shutting on 2 knobs; fins of sharks.
♂ **Perissopus** Steenstrup and Lütken, 1861 (p. 424)

Abdomen 2-segmented; caudal rami large and foliaceus--------------- 41

41. Anterior corners of genital and fourth segments produced into knobs; posterior lobes but no leg rudiments on genital segment; fins of sharks---------- ♂ **Parapandarus** Wilson, 1924 (p. 439)

Anterior corners of genital and fourth segments smoothly rounded; an accessory lobe inside the base of each carapace lobe--------- 42

42. One pair of rounded lobes at posterior corners of genital segment but no leg rudiments; maxillipeds little enlarged, claws normal; outside of sharks------------------ ♂ **Demoleus** Heller, 1865

Two pairs of pointed lobes and 2 pairs of leg rudiments at corners of genital segment; maxillipeds swollen, with stout forceps; fins of sharks--------------- ♂ **Pandarus** Leach, 1816 (p. 432)

43. Abdomen 2-segmented; thoracic segments narrower than genital segment; third segment wider than second; leg rudiments on the genital segment; gill cavity of sharks. ♂ **Gangliopus** Gerstaecker, 1854

Abdomen 1-segmented; thoracic segments wider than genital segment; second segment wider than the third------------------ 44

44. Second and third segments fused, with 1 pair of lateral lobes; maxilliped with 2 claws, shutting like scissors; no adhesion pads; outside of sharks---------------- ♂ **Achtheinus** Wilson, 1908

Second and third segments separated, second with, third without, lobes-- 45

45. Two pairs of adhesion pads at bases of 2 pairs of antennae; genital segment as long as wide, showing no leg rudiments; throat of sharks------------------ ♂ **Nesippus** Heller, 1865 (p. 438)

No adhesion pads; genital segment wider than long, with a pair of leg rudiments on its lateral margins near the corners; fins of sharks--------- ♂ **Perissopus** Steenstrup and Lütken, 1861 (p. 424)

46. Only expods of second and third legs 3-segmented, endopods 2-segmented; lateral areas of carapace divided as in female; outside of sharks- ♂ **Echthrogaleus** Steenstrup and Lütken, 1861 (p. 426)

Both rami of second and third legs 3-segmented; lateral areas of carapace entire, not divided; caudal rami large, laminate; outside of sharks------------- ♂ **Dinematura** Latreille, 1829 (p. 430)

47. One or more body regions with plates or wings, or both--------------- 48

Neither plates nor wings on any of body regions-------------------- 52

48. All swimming legs transformed into lamellar plates------------------ 49

First 2 pairs of legs of usual form, third and fourth pairs transformed into laminae or lacking-------------------------------- 50

49. Carapace covering only part of metasome, without wings; dorsal plates on fourth segment covering urosome in female, wanting in male; mouth of sharks- ♂ ♀ **Anthosoma** Leach, 1816 (p. 446)

Carapace covering entire body, with anterior wings; ventral surface also covered by a fused plate; no dorsal plates; operculum of fishes--------------------- ♀ **Norion** Nordmann, 1864

50. Third and fourth legs lacking; first 2 pairs 2-segmented; carapace overlapping anterior thorax but without lateral wings; gills of sharks--------------------------- ♀ **Caetrodes** Wilson, 1906

Third and fourth legs present and variously modified---------------- 51

51. Third and fourth legs flattened laminae; carapace with lateral wings; body covered with a single dorsal plate having lobes; gills of fishes------------------------------ ♀ **Sagum** Wilson, 1913

Third and fourth legs with elongate fleshy rami; carapace without lateral wings; dorsal body plate single, without lobes; gills of fishes---------- ♂ ♀ **Lernanthropus** Blainville, 1822 (p. 447)

52. First 4 pairs of legs present and equally well developed---------------- 53

First 4 pairs of legs present, but some of them rudimentary------------ 62

One or more pairs of legs entirely lacking------------------------------ 65

53. Second antenna with a stout apical chela and no setae---------------- 54

Second antenna with a single apical claw, and often setae-------------- 57

Second antenna with setae only, no claw or chela----------------------- 61

54. Genital segment with laminate processes at its corners, extending backward on each side of abdomen; leg rami 1-segmented; fins of fishes------------------------------ ♀ **Peniculisa** Wilson, 1917

Genital segment without processes; leg rami not 1-segmented---------- 55

55. Leg rami 3-segmented; first antenna 7-segmented; genital segment cylindrical, longer than any thoracic segment----------------- 56

Leg rami 2-segmented; first antenna 5-segmented; genital segment flattened and no longer than any of thoracic segments preceding it; dredged, 360 fathoms----- ♀ **Pontopsyllus** T. Scott, 1894

56. Carapace with posterior and median lobes; between the two on either side a stout dorsal spine; a spine also inside each leg; gills of sharks----------------- ♂ ♀ **Krøyeria** Beneden, 1853 (p. 452)

Carapace without lobes, squarely truncated posteriorly; no spines either on dorsal surface or inside base of each leg; gills of sharks------------------- ♂ ♀ **Krøyerina**, new genus (p. 457)

57. Legs all uniramose, 2-segmented, without setae, end segment with spines; first antennae 5-segmented; caudal rami lanceolate, without setae; gills of rays----------- ♀ **Ergasilina** Beneden, 1851

Legs all biramose, armed with setae and not spines-------------------- 58

58. Rami of first 3 pairs of legs 2-segmented, of fourth pair 1-segmented; head and first segment fused, second and third segments free, fourth and fifth fused; gills of eels. ♂ ♀ **Congericola** Beneden, 1854

Rami of first 4 pairs of legs segmented alike; fourth segment free, not fused-- 59

59. All the rami 2-segmented; fifth legs uniramose, 2-segmented; maxillipeds very large and armed with powerful sickle-shaped apical claws; gills of sharks--------- ♂ ♀ **Nemesis** Risso, 1826 (p. 460)

All the rami 3-segmented; fifth legs uniramose, 1-segmented; maxillipeds turned forward and tipped with several curved claws; gills of fishes-------------------- ♂ **Lernaea** Linnaeus, 1758

All the rami 3-segmented, often partly fused; fifth legs uniramose, 1-segmented; maxillipeds with chela or claw------------------ 60

60. Maxillipeds turned outward, their basal segments separated, each huge chela shutting horizontally; first antenna 5- to 7-segmented; gills of sharks--- ♂ ♀ **Eudactylina** Beneden, 1853 (p. 466)

Maxillipeds turned outward, but uncinate; first antenna 8-segmented, 2 basal segments enlarged with curved posterior claws; gills of sharks-- ♂ ♀ **Eudactylinodes**, new genus (p. 468)

Maxillipeds turned forward, their basal segments fused, each with a simple apical claw shutting vertically; first antenna 11-segmented; gills of rays------ ♂ ♀ **Eudactylinella**, new genus (p. 471)

61. Leg rami 1- or 2-segmented; urosome as long as metasome; anterior thoracic segments shorter than the posterior; gills of fishes----------------------------- ♀ **Lamproglena** Nordmann, 1832

Leg rami 3-segmented; urosome shorter than the metasome; anterior thoracic segments longer than the posterior; on an annelid---------------------------------- ♀ **Donusa** Nordmann, 1864

62. First 3 pairs of legs uniramose, fourth pair biramose, all 1-segmented; first antenna 9-segmented; caudal rami cylindrical, setose; gills of fishes-------------------- ♀ **Bassettithia** Wilson, 1922

First 2 pairs of legs biramose, last 2 uniramose, all rami 2-segmented-- 63

First and second legs not segmented alike, third and fourth pairs 1-segmented--- 64

63. Carapace nearly as wide as long, with lateral and posterior lobes; genital segment with rounded lobes at posterior corners; gills of cephalopods------------ ♂ **Pennella** Oken, 1816 (p. 489)

Carapace without lobes, one-half longer than wide; genital segment also without lobes at its posterior corners, longer than wide; gills of fishes------ ♂ **Lernaeocera** Blainville, 1822 (p. 485)

64. First, third, and fourth legs uniramose, second legs biramose, all rami 1-segmented; first antennae 3-segmented; caudal rami lanceolate and setose; gills of fishes.
♂ ♀ **Pseudocycnus** Heller, 1865 (p. 474)

First endopods 1-segmented, exopods and both rami of second legs 2-segmented, third and fourth legs uniramose, 1-segmented; caudal rami laminate; gills of fishes.
♀ **Pseudoclavella** Bassett-Smith, 1898

65. First 2 pairs of legs biramose, exopods 3-, endopods 2-segmented; third legs uniramose, 2-segmented; fourth and fifth legs lacking; in surface tow---------- ♀ **Eurynotopsyllus** T. Scott, 1901

First 2 pairs of legs biramose, third pair uniramose, all rami 2-segmented; fourth and fifth legs lacking; genital segment and abdomen fused; fins of fishes- ♂ **Sarcotretes** Jungersen, 1911 (p. 484)

First 2 pairs of legs biramose, third, fourth, and fifth pairs uniramose, replaced by setae or lacking----------------------------- 66

First legs only biramose, second and third uniramose, fourth and fifth lacking-- 67

66. Rami of first 2 pairs of legs 2-segmented; third and fourth pairs replaced by setae or lacking; second antenna with a stout terminal claw; gills of fishes----- ♂ ♀ **Hatschekia** Poche, 1902 (p. 476)

Rami of first 2 pairs of legs 1-segmented; third pair uniramose, lamellar, fourth pair lacking; second antenna with a terminal chela; gills of fishes------ ♂ ♀ **Dichelesthium** Hermann, 1804 (p. 478)

67. Rami of first legs 2-segmented, of second and third legs 1-segmented; first antenna 4-segmented; second antenna 3-segmented, tipped with plumose setae; on sipunculids.
♀ **Ventriculina** Bassett-Smith, 1903

Rami of first legs 1-segmented, of second and third legs also 1-segmented; first antenna 6-segmented; second antenna 2-segmented, with apical claw; gills of fishes.
♀ **Cybicola** Bassett-Smith, 1898

68. Trunk straight; legs close together near head; ovisacs filiform, eggs uniseriate; abdomen with featherlike processes; flesh of mammals and fishes--------------- ♀ **Pennella** Oken, 1816 (p. 489)

Trunk straight; legs widely separated on head, neck, and trunk; egg cases sacklike, eggs multiseriate------------------------ 69

Trunk straight; first 2 pairs of legs close to head, the others at short intervals; ovisacs filiform, eggs uniseriate------------------- 73

Trunk with sigmoid curve; legs close together near head; ovisacs filiform, convolute, or coiled in tight spirals------------------------- 78

69. Cephalic segment with 2 to 4 soft horns, symmetrically arranged---------- 70

Cephalic segment with asymmetrical protuberances, or none at all---------- 72

Cephalic segment with a pair of profusely branched soft ventral laminae and another pair on the neck away from the head; abdomen 2-segmented; gill cavity of fishes---- ♀ **Dysphorus** Kurtz, 1924

70. Neck passing insensibly into trunk; abdomen more or less fused with trunk; caudal rami present; second antennae uncinate; flesh of fishes---------- ♀ **Lernaea** Linnaeus, 1758

Trunk abruptly widened from neck; no caudal rami---------- 71

71. Abdomen separated from, and longer than, the trunk, 3-segmented; first antennae 5-segmented; second antennae 1-segmented, without setae; gills of fishes---- ♀ **Lernaeogiraffa** Zimmermann, 1922

Abdomen fused with trunk, without segmentation; first antennae 3-segmented; second antennae 2-segmented, both pairs with setae; flesh of fishes---------- ♀ **Tauröcheros** Brian, 1924

72. Neck and trunk transversely wrinkled, with traces of segmentation; head swollen, at anterior end of neck; no legs; flesh of fishes---------- ♀ **Areotrachelus** Wilson, 1924

Trunk segmented, with mouth at its anterior end; 4 pairs of legs; neck a frontal process, ending in a knob bearing antennae only; gills of fishes---------- ♀ **Therodamas** Krøyer, 1863

73. Head and thorax smooth, without processes or horns, and in line with trunk axis; abdomen 1-segmented; second antennae chelate; fins of fishes---------- ♀ **Peniculus** Nordmann, 1832 (p. 479)

Cephalothorax with horns or processes, or both, and usually bent at an angle with the neck---------- 74

74. Bilateral symmetry complete; branched frontal processes on the head, but no horns or lateral outgrowths; ovisacs straight---------- 75

Bilateral symmetry complete; lateral horns or outgrowths, but no frontal processes; ovisacs straight---------- 76

Bilateral symmetry distorted; neck attached to side of trunk; ovisacs coiled into tight spirals---------- 77

75. Head and neck straight, attached at right angles to side of trunk near anterior end; second antenna 2-segmented; 3 pairs of legs; flesh of sardine---------- ♀ **Peroderma** Heller, 1865

Head and neck with sigmoid curve, attached to anterior end of trunk; second antennae 3-segmented; 4 pairs of legs, first 2 biramose; head in heart of fish---------- ♀ **Cardiodectes** Wilson, 1917

76. Two to 10 chitin horns on head; neck not enlarged behind the legs; 1 pair of maxillae and 4 pairs of swimming legs; flesh of fishes---------- ♀ **Lernaeenicus** LeSueur, 1824 (p. 480)

Two lateral outgrowths on head; neck enlarged behind the legs; 2 pairs of maxillae and 3 pairs of swimming legs; abdomen small; flesh of fishes---------- ♀ **Sarcotretes** Jungersen, 1911 (p. 484)

77. Neck attached to anterolateral corner of trunk; abdomen hemispherical; trunk twisted; 4 pairs of swimming legs; eyes of fishes---------- ♀ **Phrixocephalus** Wilson, 1908

Neck attached to center of dorsal surface of trunk; abdomen as long as trunk, turned sidewise; 4 pairs of legs; gills of fishes. ♀ **Collipravus** Wilson, 1917

78. Head and neck with soft lateral processes; neck reflexed upon itself; abdomen two-thirds as long as trunk and tapered; gills of fishes--- ♀ **Haemobaphes** Steenstrup and Lütken, 1861 (p. 488)

Head with hard chitin horns, neck not reflexed---------- 79

79. Egg strings looped in loose masses; horns long and branched ---------- 80
Egg strings tightly coiled into regular spirals; horns varying ---------- 81

80. No abdominal processes; trunk bent in a regular sigmoid curve; cephalic horns very irregular; first antennae 3-segmented; gills of fishes ---------- ♀ **Lernaeocera** Blainville, 1822 (p. 485)
Five or six processes along each side of abdomen; trunk simply curved; horns regularly branched; first antennae 2-segmented; gills of fishes ---------- ♀ **Lernaeolophus** Heller, 1865 (p. 486)

81. Cephalic horns branched; abdomen as long as trunk, with many lateral processes; neck very short, nearly obsolete; gills of fishes ---------- ♀ **Haemobaphoides** T. and A. Scott, 1913
Cephalic horns unbranched; abdomen half as long as trunk, without lateral processes; neck much longer than trunk; flesh of fishes ---------- ♀ **Trifur** Wilson, 1917

KEY TO THE GENERA OF THE SUBORDER LERNAEOPODOIDA

(The swimming legs are entirely absent in more than half of the genera of this group, and hence distinctions must be based largely upon the relative size and shape of the body regions and upon the structure of the antennae and maxillae)

1. Parasite fastened to its host by its second antennae, second maxillae, or maxillipeds, or by combinations of two or more of these ---------- 2
None of the regular appendages used for attachment, but the parasite buries its head and neck in the tissues of its host ---------- 60
Parasite not fastened to its host, but lying free within certain canals, sinuses, or glands, or in the flesh of its host ---------- 82
Parasite not fastened to its host, but lying inside a gall within the body of the host; antennae and mouth parts present, but no legs; in sea urchins ---------- ♂ ♀ **Pionodesmotes** Bonnier, 1898

2. Second antennae nonprehensile or lacking; second maxillae uncinate, serving with the maxillipeds for attachment to the host ---------- 3
Second antenna prehensile; second maxillae nonprehensile; 2 posterior pairs of legs modified or lacking ---------- 9
Second antennae nonprehensile; second maxillae fused at their tips, with a prehensile bulla; adults without legs ---------- 25
Second antennae modified into tripartite horns; second maxillae and maxillipeds uncinate; 4 pairs of leg rudiments; gills of fishes.
♀ **Trichthacerus** Krøyer, 1863

3. Abdomen 1-segmented; first antenna indistinctly segmented; 2 pairs of biramose legs, rami 1-segmented; no ovisacs; head fused with the trunk; marsupium of amphipods.
♂ ♀ **Stenothocheres** Hansen, 1897
Abdomen lacking, but caudal rami often present; 2 pairs of swimming legs present, uniramose and 1-segmented ---------- 4

4. Genital area present; genital apertures close together, their chitin rings more or less fused ---------- 5
Genital area lacking; genital apertures widely separated, rings not fused; second antennae, legs, and caudal rami lacking ---------- 8

5. Legs and caudal rami with wide basal and narrow distal portions, tapered to a sharp point; abdomen and second antennae lacking; gills of *Cumacea*-------------- ♂ ♀ **Homoeoscelis** Hansen, 1897

Legs and caudal rami sometimes lacking; when present cylindrical, short, bluntly rounded, and tipped with 2 or 3 setae------------ 6

6. Legs and caudal rami lacking; maxillipeds rudimentary, shorter than the maxillae; body of female flattened, wider than long; male unknown; gills of Crustacea-------- ♀ **Choniostoma** Hansen, 1886

Legs and caudal rami usually present, but rudimentary; body of female spherical, of male ovoid or subglobular-------------------- 7

7. Maxillipeds poorly developed, 3-segmented; caudal rami completely fused; genital area with a large protuberance directed downward; on an ostracod----------- ♀ **Sphaeronellopsis** Hansen, 1905

Maxillipeds well developed, 4-segmented; caudal rami completely separated, sometimes wholly lacking; no protuberance on the genital area; marsupium of Crustacea.

♂ ♀ **Sphaeronella** Salensky, 1868

8. Maxillipeds short and weak in female, well developed in male; trunk covered more or less thickly with short hairs posteriorly; marsupium of Crustacea----------------- ♂ ♀ **Mysidion** Hansen, 1897

Maxillipeds wanting in female, present in male, but weakly developed; trunk entirely naked; first antennae short, with but one segment; outside of Crustacea.

♂ ♀ **Aspidoecia** Giard and Bonnier, 1889

9. Macroscopic females, attached to the host---------------------------- 10

Microscopic males, attached to the females--------------------------- 19

10. Body elongated, symmetrical or only slightly irregular; ovisacs straight, cylindrical or club-shaped------------------------------- 11

Body short, wider than long and very asymmetrical; ovisacs twisted and usually somewhat concealed--------------------------- 18

11. Head produced posteriorly into a cephalic neck; antennae on frontal margin, mouth and mouth parts at base of neck--------------- 12

No cephalic neck; mouth and mouth parts on ventral surface of head, not as widely separated from the antennae---------------- 14

12. Head small, each lateral process tapered to a blunt point; trunk faintly 4-segmented; no legs, dorsal or ventral processes; mouth of fishes------------------------- ♀ **Medesicaste** Krøyer, 1863

Head larger, each lateral process broadly rounded; leg rudiments present; trunk distinctly divided into 2 segments------------------ 13

13. Leg rudiments bipartite, angular, interlocked; anterior trunk with 2 dorsal processes, posterior without lateral processes; gills of fishes------------------------ ♀ **Lernentoma** Blainville, 1822

Leg rudiments tripartite, separated; anterior trunk with 2 dorsal processes, posterior with 2 pairs of lateral processes; gills of fishes---------------- ♀ **Oralien** Bassett-Smith, 1899 (p. 494)

14. Head fused with metasome, armed with 6 knobs, 2 anterior, 2 dorsal, 2 ventral; genital segment with 8 dactylose processes; no legs; mouth of fishes------------------ ♀ **Strabax** Nordmann, 1864

Head separated; metasome fused and unsegmented; urosome 2-segmented with caudal rami; 2 pairs of legs, no horns, knobs, or processes; gills of fishes------- ♀ **Blias** Krøyer, 1863 (p. 493)

Head separated; metasome with 1 or 2 free segments, paired horns or lateral processes and unpaired dorsal knobs or laminae-- 15

Head fused with first segment, separated from second segment by a short neck; 1 or more pairs of legs and processes, but no knobs-- 16

Head separated; metasome usually 4-segmented; no horns or dorsal knobs, but paired lateral processes and 2 pairs of legs---------- 17

15. First 2 segments free, rest of thorax fused with lateral knobs and dorsal laminae; legs uniramose, end segments boot-shaped; gills of fishes-------------- ♀ **Chondracanthopsis**, new genus (p. 508)

First segment only free, rest of thorax fused with 3 pairs of lateral processes turned ventrally; head deflexed; legs biramose; gills of fishes--------- ♀ **Chondracanthodes**, new genus (p. 506)

First segment only free, rest of thorax fused without lateral processes; a horn at each anterior corner of head; 1 pair of legs; gills of fishes--- ♀ **Pseudochondracanthus** Wilson, 1908 (p. 495)

16. Metasome segments distinctly separated, each with lateral processes; second segment with a pair of dorsal horns; 1 pair of legs; gills of fishes-------------------- ♀ **Juanettia** Wilson, 1921

Metasome segments completely fused, without lateral processes; no dorsal horns; second antennae tripartite; 2 pairs of leg rudiments; gills of fishes------------ ♀ **Triphyllacanthus** Oakley, 1930

17. Head smooth, without barbs or processes; metasome also without processes except 1 pair at posterior corners of the fourth segment; gills of fishes------ ♀ **Acanthochondria** Oakley, 1927 (p. 500)

Head with lateral barbs or posterior processes; metasome also with paired processes, dorsal, ventral, or lateral, any 2 or all 3; gills of fishes------- ♀ **Chondracanthus** La Roche, 1811, (p. 497)

18. Head more or less separated from trunk; latter with 3 pairs of lateral processes; abdomen 1-segmented; second antennae with terminal claws; gills of fishes-------------- ♀ **Diocus** Krøyer, 1863

Head fused with metasome; latter with 1 pair of lateral processes bearing knobs and lobes; second antenna a multifid horn; gills of fishes-------- ♀ **Tanypleurus** Steenstrup and Lütken, 1861

19. Leg rudiments entirely lacking; no abdomen; body segments indistinct; each caudal ramus conical and divided distally; gills of fishes-------- ♂ **Pseudochondracanthus** Wilson, 1908 (p. 495)

Two pairs of leg rudiments, biramose, rami 1-segmented, exopods with spines; second antenna 3-segmented, end segment with outer accessory claw; gills of fishes.
♂ **Chondracanthodes**, new genus (p. 506)

Two pairs of leg rudiments, uniramose, 2-segmented, setose------------ 20

Two pairs of leg rudiments, uniramose, 1-segmented, setose------------ 21

Five pairs of leg rudiments, anterior pairs biramose------------------ 24

20. Antennal area separated from head; trunk 4-segmented; caudal rami setiform; end segment of each leg with 1 apical seta; mouth of fishes ---------------------- ♂ **Medesicaste** Krøyer, 1863
    Antennal area not separated; trunk 6-segmented; caudal rami conical; end segment of each leg with 3 or 4 apical setae; mouth of fishes ---------------------- ♂ **Strabax** Nordmann, 1864
21. Head and first 2 segments fused, bearing all the appendages ---------- 22
    Head and first segment only fused; second segment free and bearing second legs; each leg ramus cylindrical, with 2 apical setae; gills of fishes ------- ♂ **Chondracanthus** La Roche, 1811 (p. 497)
    Head separated from thorax, first 2 free segments bearing legs ---------- 23
22. First leg laminate, with 2 apical spines and an anterior process with 1 spine; second leg with a single spine; trunk 5-segmented; gills of fishes --------- ♂ **Oralien** Bassett-Smith, 1899 (p. 494)
    Each ramus of both pairs of legs laminate, with 3 or 4 apical setae; trunk made up of 4 segments; caudal rami setalike; gills of fishes ------------- ♂ **Acanthochondria** Oakley, 1927 (p. 500)
    Each ramus laminate with 2 minute apical setae; trunk with 3 segments only; caudal rami conical, each tipped with 1 cilium; gills of fishes ------ ♂ **Chondracanthopsis**, new genus (p. 508)
23. Trunk 4-segmented; maxillipeds 3-segmented, with slender apical claw; caudal rami definitely longer than last trunk segment; gills of fishes ----------------- ♂ **Blias** Krøyer, 1863 (p. 493)
    Trunk 5-segmented; maxillipeds 2-segmented, with a stout claw; caudal rami definitely shorter than last trunk segment; gills of fishes ------------------ ♂ **Trichthacerus** Krøyer, 1863
24. First 2 pairs of legs biramose, rami 1-segmented; third and fourth pairs minute knobs; fifth pair biramose, rami 1-segmented; gills of fishes -------------------- ♂ **Diocus** Krøyer, 1863
    First 4 pairs of legs biramose, rami 2-segmented and well armed with setae; fifth pair uniramose, 1-segmented, with 1 seta; gills of fishes -------------------------- ♂ **Juanettia** Wilson, 1921
25. Macroscopic females, attached to the host ------------------------- 26
    Microscopic males, attached to the females ------------------------ 45
26. Maxillipeds on inside of base of second maxillae, considerably behind the mouth; head narrowed, sometimes arched dorsally; gills of fishes ------------- ♀ **Tracheliastes** Nordmann, 1832
    Maxillipeds inside of second maxillae, both close to the mouth; head not narrowed, in line with trunk or bent forward -------------- 27
    Maxillipeds far behind the mouth; second maxillae equally far behind maxillipeds; head not narrowed, in line with trunk or bent backward ------------------------------------ 30
    Maxillipeds close to mouth; second maxillae far behind maxillipeds; head narrowed, wormlike, in line with trunk or bent backward --- 34
27. Second maxillae much longer than the head; the latter separated from the trunk by a groove, often by a short neck ------------ 28
    Second maxillae about the same length as the head; the latter completely fused with the trunk, the two unsegmented ------------ 32
    Second maxillae shorter than the head; the latter separated from the trunk; body faintly segmented; no caudal rami; gills of fishes ------------------------ ♀ **Vanbenedenia** Malm, 1860

28. Neither caudal rami nor posterior processes present---------- 29
Posterior processes present, but no caudal rami---------- 31
Caudal rami present, but no posterior processes; neck 2-segmented; second maxillae on a level with the dorsal surface; eyes of sharks---------- ♀ **Ommatokoita** Leigh-Sharpe, 1926

29. Abdomen present, usually segmented; trunk also more or less segmented; exopod of second antenna 2-segmented; a partial carapace; gills, fresh-water fishes---------- ♀ **Achtheres** Nordmann, 1832
No abdomen; trunk not segmented; exopod of second antenna 1-segmented---------- 30

30. Head with a carapace; no genital process or abdomen; first antennae 2-segmented; distal three-fourths of second maxillae fused; scales of fishes---------- ♀ **Lernaeopodopsis** Hansen, 1923
Head without a carapace; a genital process but no abdomen; first antennae 3-segmented; second maxillae separate to their tips; gills of fishes---------- ♀ **Salmincola** Wilson, 1915

31. Two posterior processes ventral to ovisacs; second and third segments separated from trunk; exopod of second antenna usually 2-segmented; skin of sharks---------- ♀ **Lernaeopoda** Blainville, 1822
Two posterior processes dorsal to ovisacs; second and third segments fused with the trunk; exopod of the second antenna usually 1-segmented; gills of rays---------- ♀ **Lernaeopodina** Wilson, 1915

32. Head with a neck; trunk with longitudinal rows of knobs; first antennae 2-segmented; second antennae biramose, rami 1-segmented; gill cavity of fishes---------- ♀ **Basanistes** Nordmann, 1832
Fused head and trunk smooth, without knobs; first antennae 2-segmented; second antennae uniramose, 1-segmented; second maxillae fused distally; gills of fishes. ♀ **Nectobrachia** Fraser, 1920

33. Second maxillae shorter than head, three-fourths fused, with branching horns instead of a bulla; mouth tube minute and depressed; gills of ray---------- ♀ **Brianella** Wilson, 1915
Second maxillae twice as long as head, entirely separate, with a normal bulla; mouth tube large, projecting visibly; gills of skates---------- ♀ **Thomsonella** Wilson, 1915

34. Trunk or second maxillae, or both, with deeply incised fimbriate processes; head in line with the trunk---------- 35
Neither trunk nor second maxillae with fimbriate processes; head inclined to trunk, rarely in line with it---------- 36

35. Head short, stout, and straight; anterior fimbriae on second maxillae, posterior on distal end of trunk; ovisacs concealed; gills of fishes---------- ♀ **Thysanote** Krøyer, 1863 (p. 509)
Head long, slender, and arched; fimbriae all on lateral margins of trunk, none on end; ovisacs plainly visible dorsally; mouths of fishes---------- ♀ **Thysanotella** Wilson, 1915

36. Head short and wide, in line with trunk or flexed---------- 37
Head long and wormlike, and always curved or flexed---------- 38

37. Head separated from trunk by a short neck; second maxillae completely fused, with a bulla; no caudal rami or processes; lips of fishes---------- ♀ **Cauloxenus** Cope, 1872
Usually a long neck; second maxillae separate, ending in clasping hands or a bulla; 2 dorsal posterior processes on trunk; spiracles of fishes---------- ♀ **Charopinus** Krøyer, 1863 (p. 511)

38. Second maxillae flat muscle bands, joined at tips, without a bulla; abdomen unsegmented, with caudal rami; no posterior processes; gills of fishes ---------------- ♀ **Naobranchia** Hesse, 1863
Second maxillae short and completely fused, often only the bulla visible; a genital process, but no abdomen or caudal rami ----------- 39
Second maxillae long and separate except at the bulla; a genital and 0–8 posterior processes; no abdomen or caudal rami ------------- 42

39. Neck usually in line with second maxillae, the two continuous and attached to anterior end of trunk ------------------------------- 40
Neck usually at an angle with second maxillae, the former attached to side of trunk, the latter to its anterior end -------------- 41

40. Second antennae uniramose; first antennae 3-segmented; head often longer than trunk; a genital but no posterior processes; gills and fins of fishes ---------------- ♀ **Clavella** Oken, 1815 (p. 513)
Second antennae biramose; first antennae often 4-segmented; head shorter and stouter; posterior processes usually present; mouth and fins of fish ------------------ ♀ **Clavellopsis** Wilson, 1915

41. Second antennae turned across frontal margin; first maxillae tripartite; first antennae setose; head reflexed dorsally; gills of fishes ----------------------- ♀ **Clavellodes** Wilson, 1915 (p. 516)
Second antennae turned forward; first antennae spinose; first maxillae bipartite usually; head wormlike, not reflexed; gills of fishes ------------------------- ♀ **Clavellisa** Wilson, 1915 (p. 517)

42. No genital or posterior processes; no carapace; exopod of second antenna 1-segmented; second maxillae not fused at tip; usually no bulla; gills of fishes ----------- ♀ **Eubrachiella** Wilson, 1915
A genital, and 2 to 4 posterior, processes; a carapace; exopod of second antenna 2-segmented; maxillae fused with a bulla ---------- 43
No genital, but 6 to 8 posterior, processes; head flexed forward and not backward -- 44

43. First maxillae usually bipartite, palp with a single spine; second maxillae dactylose at tips, or with a clavate bulla; gills of fishes ----------------- ♀ **Parabrachiella** Wilson, 1915 (p. 519)
First maxillae usually tripartite, palp with 2 spines; second maxillae never dactylose, but with the usual button bulla; gills of fishes --------------------- ♀ **Brachiella** Cuvier, 1830 (p. 520)

44. No carapace; first antennae 4-segmented; first maxillae bipartite, palp with 2 stout spines; second maxillae separate to tips; gills of fishes ------------------- ♀ **Epibrachiella** Wilson, 1915
A distinct carapace; first antennae 3-segmented; first maxillae tripartite, no palp; second maxillae completely fused; gills of fishes ------------------------------- ♀ **Probrachiella** Wilson, 1915

45. Anterior and posterior portions of body in same line or curve, neither bent at an angle nor folded upon itself ---------------------- 46
Anterior and posterior portions of body at more or less of an angle, sometimes completely folded together and fused -------------- 55

46. Head separated from trunk, which is often segmented ----------------- 47
Head completely fused with trunk, which is never segmented ----------- 54

47. Trunk showing definite segmentation --------------------------------- 48
Trunk without any traces of segmentation --------------------------- 51

48. Trunk much longer than head and neck ------------------------------ 49
Trunk much shorter than head and neck ----------------------------- 50

49. Caudal rami uncinate; second maxillae much longer than maxillipeds; first antennae 3-segmented, setose; second antennae biramose, exopod 2-segmented; gills of fresh-water fishes ♂ **Achtheres** Nordmann, 1832

Caudal rami large, laminate, bluntly rounded; second maxillae about as long as maxillipeds; first and second antennae not yet known; gills of salt-water fishes ♂ **Epibrachiella** Wilson, 1915

50. Trunk 3-segmented; second antennae uniramose, 2-segmented; maxillipeds larger than second maxillae, their terminal claws bent almost in a circle; mouths of fishes ♂ **Thysanotella** Wilson, 1915

Trunk 4- or 5-segmented; second antennae biramose; maxillipeds shorter than second maxillae, their terminal claws slender, almost straight; spiracles of fishes ♂ **Charopinus** Krøyer, 1863 (p. 511)

51. Caudal rami often lacking; trunk not longer than head 52

Caudal rami always present; trunk longer than head 53

52. No dorsal carapace; first antennae 1-segmented; second antennae uniramose, 1-segmented; second maxillae considerably longer than maxillipeds; gills of fishes ♂ **Vanbenedenia** Malm, 1860

A distinct carapace; first antennae 3-segmented; second antennae biramose; second maxillae and maxillipeds usually same length; gills of fishes ♂ **Brachiella** Cuvier, 1830 (p. 520)

53. No dorsal carapace; first antennae 3-segmented; second antennae biramose; maxillae and maxillipeds with falcate claws, sometimes twisted badly; gills of fishes ♂ **Thysanote** Krøyer, 1863 (p. 509)

A distinct carapace; first antennae 4-segmented; second antennae uniramose, 4-segmented, with apical chela; maxillipeds longer than second maxillae; skin of sharks. ♂ **Lernaeopoda** Blainville, 1822

54. Head and anterior trunk fused and covered with a carapace; second antennae biramose; second maxillae longer than maxillipeds; gills of fishes ♂ **Naobranchia** Hesse, 1863

Head and trunk separated, no dorsal carapace; second antennae uniramose; second maxillae and maxillipeds same length, chelate; gills of fishes ♂ **Probrachiella** Wilson, 1915

55. Body bent once, head at right angles to trunk 56

Body bent twice, anterior head and posterior trunk parallel and at right angles to middle of body 57

Body folded and completely fused, with no distinction of parts 58

56. No dorsal carapace; second antennae biramose, rami 1-segmented; first maxillae tripartite; caudal rami small, without setae; gills of fishes ♂ **Parabrachiella** Wilson, 1915 (p. 519)

A distinct carapace; second antennae uniramose, 3-segmented, with stout apical claw; first maxillae bipartite; no caudal rami; gills of fishes ♂ **Eubrachiella** Wilson, 1915

57. Head separated from trunk; each ramus of second antenna and first maxilla with 2 apical spines; caudal rami present; gills of rays ♂ **Lernaeopodina** Wilson, 1915

Head fused with trunk; rami of second antenna without spines; first maxilla with 3 apical spines; caudal rami not present; fins of fishes ♂ **Clavellopsis** Wilson, 1915

58. Body an ellipsoid, its frontal margin squarely truncated; distal end of trunk on this margin beside mouth parts; gills of fishes. ♂ **Clavellodes** Wilson, 1915 (p. 516)

Body an ovoid, its frontal margin very oblique; distal end of trunk considerably behind mouth parts ---------- 59

59. No dorsal carapace or genital process; first antenna 2-segmented; second antenna uniramose, 3-segmented; first maxilla small, bipartite; gills of fishes - ♂ **Clavella** Oken, 1815 (p. 513)

A distinct carapace and genital process; first antenna 3-segmented; second antenna biramose, the rami 1-segmented; first maxilla tripartite; gills of fishes - ♂ **Clavellisa** Wilson, 1915 (p. 517)

60. Macroscopic females, attached to host ---------- 61

Microscopic males, attached to females ---------- 77

61. Head or neck, or both, with horns or processes for anchoring the copepod; some of the segmented appendages present ---------- 62

Head and neck greatly modified and fused with tissues of host, with a chitin anulus; no horns or appendages ---------- 66

62. Posterior processes cylindrical, smooth, each 3-segmented; neck twisted, with short chitin processes; head much wrinkled; flesh of fishes ---------- ♀ **Periplexis** Wilson, 1919

Posterior processes cylindrical, smooth, not segmented; neck and head smooth, sometimes with soft horns or processes ---------- 63

Posterior processes covered with many cones or cylinders; neck smooth, bent but not twisted, with processes or horns ---------- 65

63. Head orbicular, neck stout, depressed, neither of them with horns or processes; 2 long posterior processes on trunk; gill cavity of sharks ---------- ♀ **Opimia** Wilson, 1908

Head with conspicuous processes or horns ---------- 64

64. Head with 3 pairs of globular processes; neck slender, cylindrical; 2 posterior processes dorsal to egg strings; gill cavity of sharks ---------- ♀ **Paeon** Wilson, 1919 (p. 524)

Head with stiff cartilaginous horns; neck filiform, widened posteriorly; 2 posterior processes ventral to egg strings; gills of fishes ---------- ♀ **Trypaphylum** Richiardi, 1878

65. Head a narrow cylinder, with lateral processes at posterior end; neck filose; posterior processes covered with cylinders; flesh of fishes ---------- ♀ **Rebelula** Poche, 1902 (p. 528)

Head wide with enormous lateral processes; neck stout; posterior processes dichotomously branched; no cylinders; flesh of fishes ---------- ♀ **Sphyrion** Cuvier, 1830 (p. 530)

66. Body of female distinctly segmented; annulus[29] ventral; male a pygmy, not segmented, with 2 pairs of antennae and 1 pair of mouth parts; skin of annelids ---------- ♀ **Melinnacheres** M. Sars, 1870

Body of female distinctly segmented; annulus terminal; male unknown; skin of annelids ---------- ♀ **Oestrella** McIntosh, 1885

Body of female without any trace of segmentation ---------- 67

67. Neck with a well-defined annulus,[29] the head and neck often incapable of separation from tissues of host ---------- 68

No neck or annulus,[29] the anterior portion of trunk fused directly with tissues of host ---------- 76

68. Body of female twice as long as wide, or even longer ---------- 69

Body of female about the same length and width ---------- 72

Body of female definitely wider than long ---------- 74

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[29] A chitin ring at the base of the neck where it joins the trunk.

69. Annulus terminal at anterior end of an ovoid, symmetrical body; ovisacs spindle-shaped, four times as long as wide; on annelids............................... ♀ **Saccopsis** Levinsen, 1878

Body squarely truncated at both ends; annulus ventral, nearer anterior end; ovisacs cylindrical, eight times as long as wide; dredged, 8 fathoms (see p. 603).............. ♀ **Jeanella** T. Scott, 1904

Body rounded at one or both ends; annulus ventral, nearer posterior end; ovisacs ovoid, twice as long as wide..................... 70

70. Head fused with tissues of host; neck short, stout; annulus thick; trunk enlarged at each posterior corner, with ovoid ovisacs; on annelids...... ♀ **Herpyllobius** Steenstrup and Lütken, 1861

Head capable of separation from tissues of host and furnishing important diagnostic characters.................................. 71

71. Head clavate, with fleshy expansions; neck short and stout; trunk laterally compressed and evenly rounded posteriorly; on annelids...................... ♀ **Hedyphanella** Leigh-Sharpe, 1926

Head mushroom-shaped; neck curved, elongate; trunk bilobed posteriorly, 1 ovisac issuing from each of the lobes; on annelids......................... ♀ **Phallusiella** Leigh-Sharpe, 1926

72. Trunk of female ovoid; head unknown; neck terminal, very thick; each ovisac hemispherical, much larger than trunk; on annelids............................ ♀ **Bradophila** Levinsen, 1878

Trunk of female ovoid or spherical; neck ventral and nearer posterior end of trunk.. 73

73. Head expanded and flattened with crenate edges, concave anteriorly; neck short, filiform; trunk without lobes; on annelids................. ♀ **Herpyllobius** Steenstrup and Lütken, 1861

Head unknown; neck short and very stout; annulus thick; trunk with 2 spherical lobes at posterior end; on annelids. ♀ **Sarsilenium** Leigh-Sharpe, 1926

74. Trunk of female napiform; head terminal, rhizoid; neck slender, fused with head; no annulus; ovisacs spherical; on crustacea. ♀ **Rhizorhina** Hansen, 1892

Trunk subtrapezoidal or saccate; head unknown; neck ventral.......... 75

75. Trunk depressed; neck nearer anterior end; ovisacs reniform and turned forward along sides of trunk; on annelids. ♀ **Eurysilenium** M. Sars, 1870

Trunk swollen; neck nearer posterior end; ovisacs cylindrical, extending straight backward, longer than trunk; on annelids. ♀ **Eurysileniopsis** Gravier, 1912

76. Trunk transversely semilunar, concave side fused with wall of host's alimentary canal; no head, neck, or annulus; on annelids............................. ♀ **Aphanodomus** Wilson, 1924

Trunk cylindrical, one end fused with host, alimentary canal of copepod opening into that of annelid; hermaphroditic; on annelids.............. ♀ **Xenocoeloma** Caullery and Mesnil, 1915

77. Body folded into an unsegmented ellipsoid; head separated, with a minute carapace; basal segments of maxillipeds completely fused; flesh of fishes......... ♂ **Sphyrion** Cuvier, 1830 (p. 530)

Body not folded, head and trunk in same line or curve and more or less distinctly segmented.................................. 78

78. Head with large swelling on dorsal surface at each side; trunk distinctly segmented, the segments increasing in size backward; flesh of fishes---------------- ♂ **Rebelula** Poche, 1902 (p. 528)

Dorsal surface of head without swellings; entire body distinctly segmented and cyclops-like------------------------------ 79

Dorsal surface of head without swellings; anterior body only segmented, posterior portion completely fused---------------------- 81

79. Metasome 2-segmented, urosome 2-segmented; first antennae 3-segmented; second antennae mere knobs; 2 pairs biramose legs, the rami 1-segmented; on Crustacea--- ♂ **Rhizorhina** Hansen, 1892

Metasome 4-segmented, urosome 3-segmented; 3 pairs of biramose legs-- 80

80. A fold between rostrum and head; no first antennae; rami of all 3 pairs of legs 1-segmented, exopods broad laminae; on annelids------------------------ ♂ **Sarsilenium** Leigh-Sharpe, 1926

No fold between rostrum and head; first antennae 3-segmented; exopods of first and second legs 2-segmented, endopods and third leg rami 1-segmented; on annelids.
♂ **Herpyllobius** Steenstrup and Lütken, 1861

81. Head with a carapace; first free segment well defined; first antennae 3-segmented; caudal rami each tipped with a spiny seta; gill cavity of sharks------------- ♂ **Paeon** Wilson, 1919 (p. 524)

Head without a carapace; first free segment fused with trunk; first antennae indistinctly segmented; caudal rami without setae; gills of fishes---------------- ♂ **Trypaphylum** Richiardi, 1878

82. Body of female segmented faintly or not at all, without processes; no part of body conspicuously enlarged---------------------- 83

Body of female distinctly segmented, but no part conspicuously enlarged; metasome and often urosome with soft paired processes-- 85

Body of female distinctly segmented, one part conspicuously enlarged, the rest much smaller, with or without processes------------ 89

Body of male harpactoid, attenuate, distinctly segmented; 2 pairs of biramose legs; 2 pairs of antennae------------------------ 92

83. Three pairs of leg rudiments, first 2 biramose; 2 pairs antennae, second pair only prehensile; 2 pairs mouth parts; body unsegmented; scales of fish-------------- ♀ **Lernaeascus** Claus, 1887

No leg rudiments, but body distinctly segmented; no processes--------- 84

84. Body cylindrical, smooth; 2 pairs of antennae, both prehensile; 2 pairs of mouth parts; a bilobed rostrum curved ventrally; mesogloea of polyps------------------- ♀ **Mesoglicola** Quidor, 1906

Body ovoid, covered with small papillae; 3 pairs of rudimentary mouth parts, but no antennae and no rostrum or ovisacs; flesh of fishes------------------------- ♀ **Sarcotaces** Olsson, 1872

85. One pair of soft dactylose dorsal processes on fifth segment; rudimentary antennae and mouth parts; 2 pairs biramose legs; in ascidians-------------------- ♀ **Antheacheres** M. Sars, 1870

Three to six pairs of lateral processes on metasome only--------------- 86

Fifteen pairs of soft lateral processes, on metasome and urosome, 2 pairs branched; no antennae, mouth parts, or legs; frontal sinus of fishes-------- ♀ **Philichthys** Steenstrup, 1862 (p. 531)

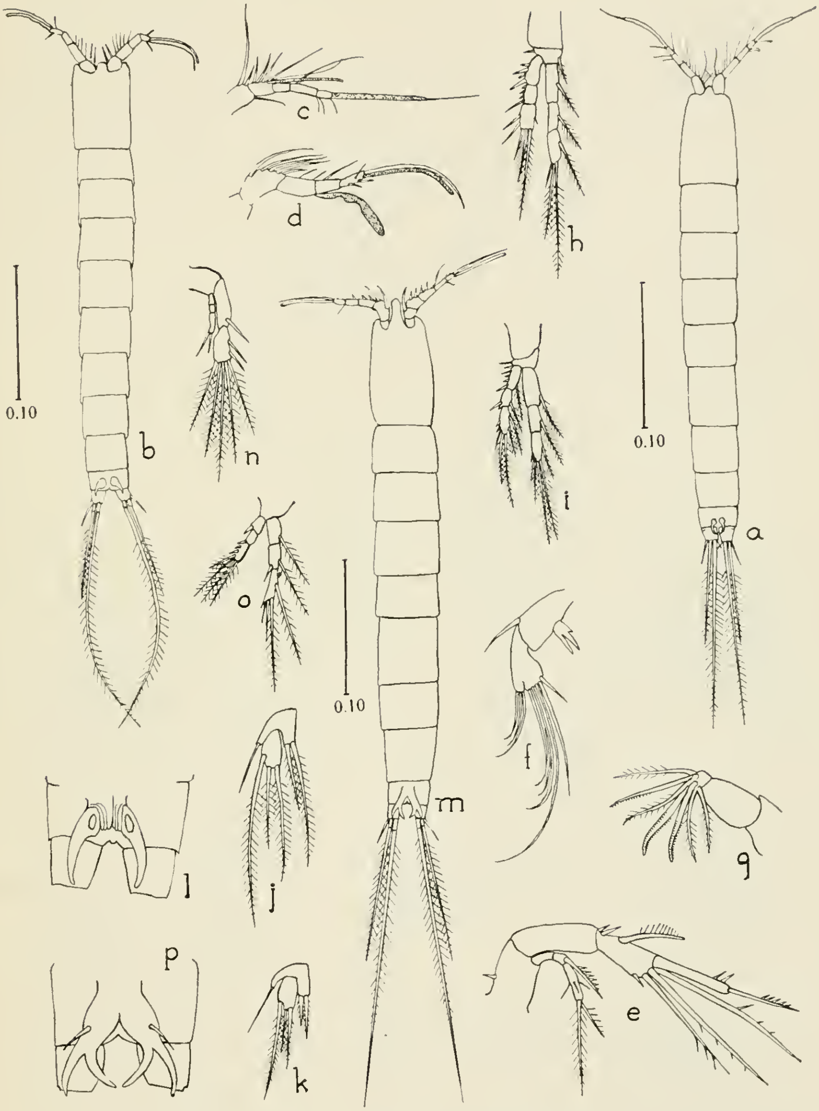
86. Ovisacs very long and slender, eggs uniseriate; neither antennae nor swimming legs present---------------------------------- 87
Ovisacs short and stout, eggs multiseriate; both pairs of antennae present, but no swimming legs---------------------------------- 88
87. Metasome coriaceous, with 4 flat processes on each side, which are not segmented, but are reticulated; 2 pairs mouth parts; on Crustacea----------------- ♀ **Chondrocarpus** Bassett-Smith, 1903
Five free metasome segments, each with a pair of lateral processes, those on first and second segments 3-segmented; no mouth parts; in actinians------------------ ♀ **Staurosoma** Will, 1844
88. Body short and stout, with 3 pairs lateral and 2 pairs ventral processes; first antenna 1-segmented; second antenna prehensile; in mollusks--------------------------- ♀ **Ismaila** Berg, 1868
Body elongate, with 6 pairs of lateral processes; first antenna 5-segmented; second antenna 3-segmented, with a stout apical claw; in mollusks--------------------- ♀ **Briarella** Berg, 1875
89. Enlarged part a fusion of fourth, fifth, and genital segments, with 2 pairs of lateral processes; a third pair on the third segment; nasal fossae of fishes----------- ♀ **Colobomatus** Hesse, 1873
Enlarged part a fusion of second, third, and fourth segments; fifth and genital segments separate, and as narrow as first segment--- 90
90. Segments of enlarged part separated by partial grooves; no processes; first and second antennae hidden; no caudal rami; lateral lines of fishes--------------------- ♀ **Leposphilus** Hesse, 1866
Segments of enlarged part completely fused and armed with one or more pairs of lateral processes------------------------------- 91
91. Enlarged part spherical, with 1 pair of processes at its center; first antennae 3-segmented; second antennae laminate, 1-segmented; frontal canals of fishes------ ♀ **Sphaerifer** Richiardi, 1874
Enlarged part trapezoidal, with 2 pairs of processes; a third pair on frontal margin, and a fourth pair on the genital segment; frontal sinus of fishes------ ♀ **Polyrrhynchus** Richiardi, 1876
92. First antennae 6-segmented, second antennae 2-segmented; exopods of legs 2-, endopods 1-segmented; no third legs; frontal sinus of fishes--------- ♂ **Philichthys** Steenstrup, 1862 (p. 531)
First antennae 4-segmented, second antennae 3-segmented; both rami of legs 2-segmented; third legs uniramose; frontal sinus of fishes--------------------- ♂ **Polyrrhynchus** Richiardi, 1876

EXPLANATION OF PLATES

Plate 1

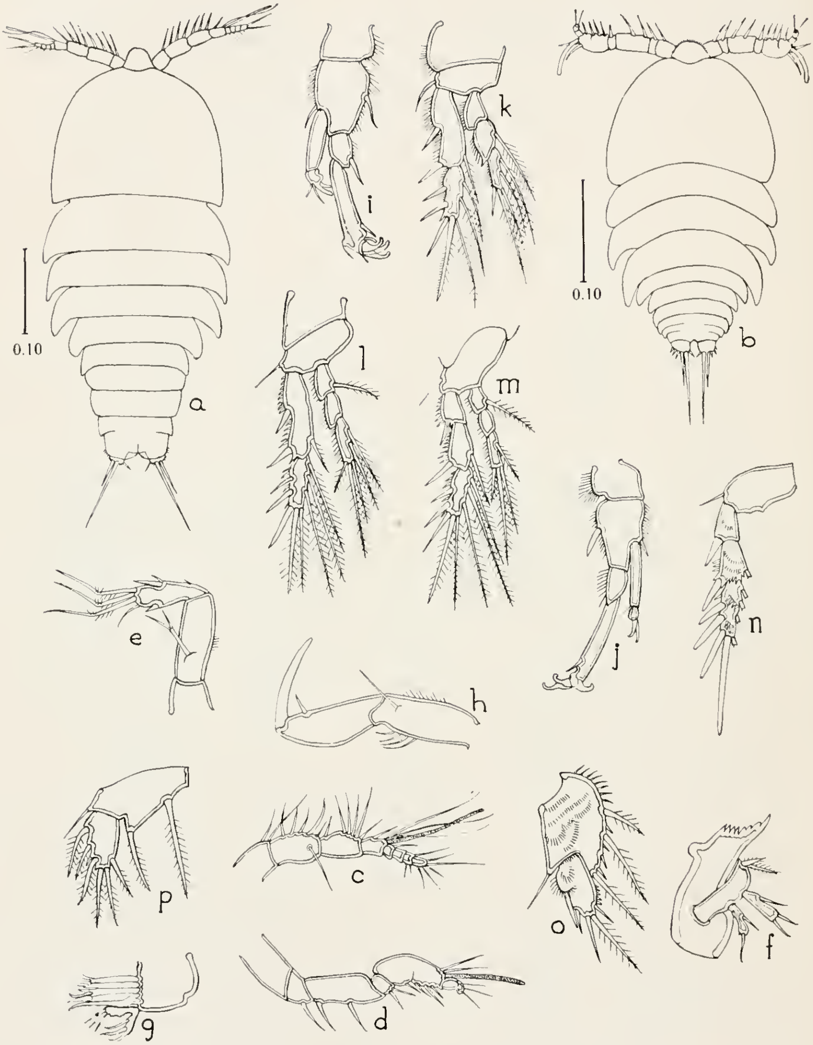
(Frontispiece)

a, *Chondracanthus merlucii*, female, dorsal; *b*, *Chappaquiddicka pulchella*, new genus, new species, female, dorsal; *c*, *Doropygus laticornis*, female, lateral; *d*, *Elytrophora atlantica*, female, dorsal; *e*, *Sapphirina scarlata*, male, dorsal (drawn and colored by Richard Rathbun); *f*, *Diaptomus leptopus*, female, dorsal. (All figures except *e* drawn by the author and colored by Miss Nevartte Bedrossian. This color plate has been made possible through the generosity of Dr. Mary J. Rathbun, associate in zoology in the Smithsonian Institution, and Dr. Charles B. Wilson, the author.)—Ed.



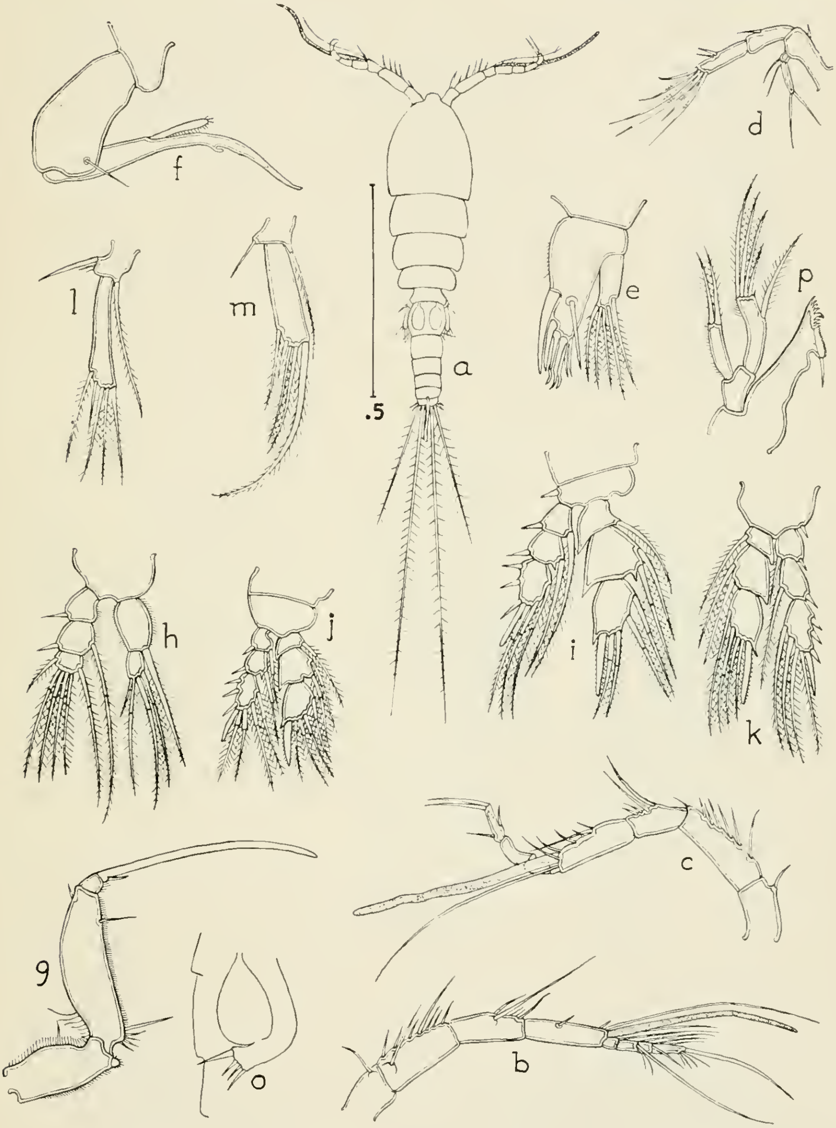
ARENOSETELLA, NEW GENUS

Arenosetella spinicauda, new species: *a*, Female, dorsal; *b*, male, dorsal; *c*, female, first antenna; *d*, male, first antenna; *e*, female, second antenna; *f*, mandible and palp; *g*, second maxilla; *h*, first leg; *i*, fourth leg; *j*, female, fifth leg; *k*, male, fifth leg; *l*, dorsal surface of anal segment of abdomen, showing claws. *Arenosetella fissilis*, new species: *m*, Female, dorsal; *n*, second antenna; *o*, first leg; *p*, dorsal surface of anal segment of abdomen, showing claws.



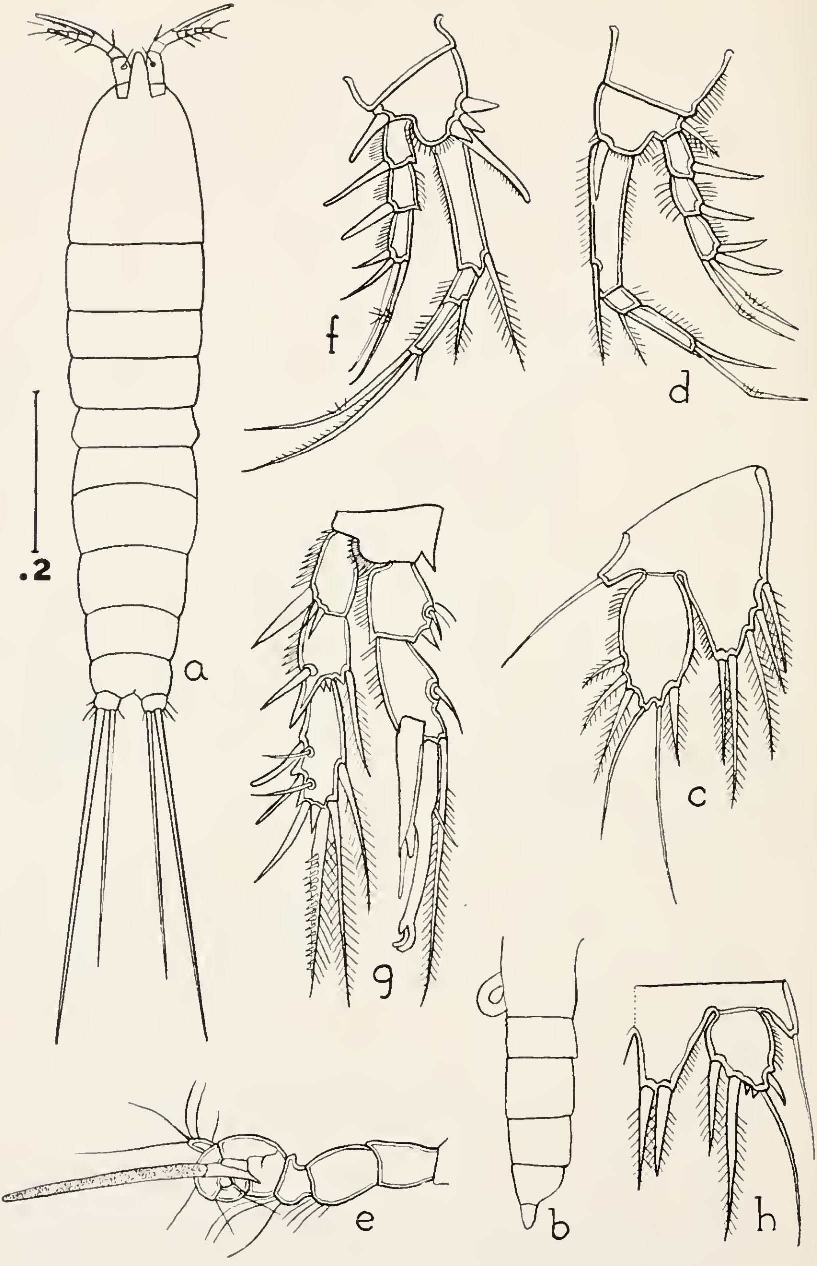
ZAUSODES ARENICOLUS, NEW GENUS, NEW SPECIES

a, Female, dorsal; *b*, male, dorsal; *c*, female, first antenna; *d*, male, first antenna; *e*, female, second antenna; *f*, mandible and palp; *g*, second maxilla; *h*, maxilliped; *i*, female, first legs; *j*, male, first legs; *k* *m*, female, second, third, and fourth legs; *n*, male, fourth exopod; *o*, female, fifth leg; *p*, male,



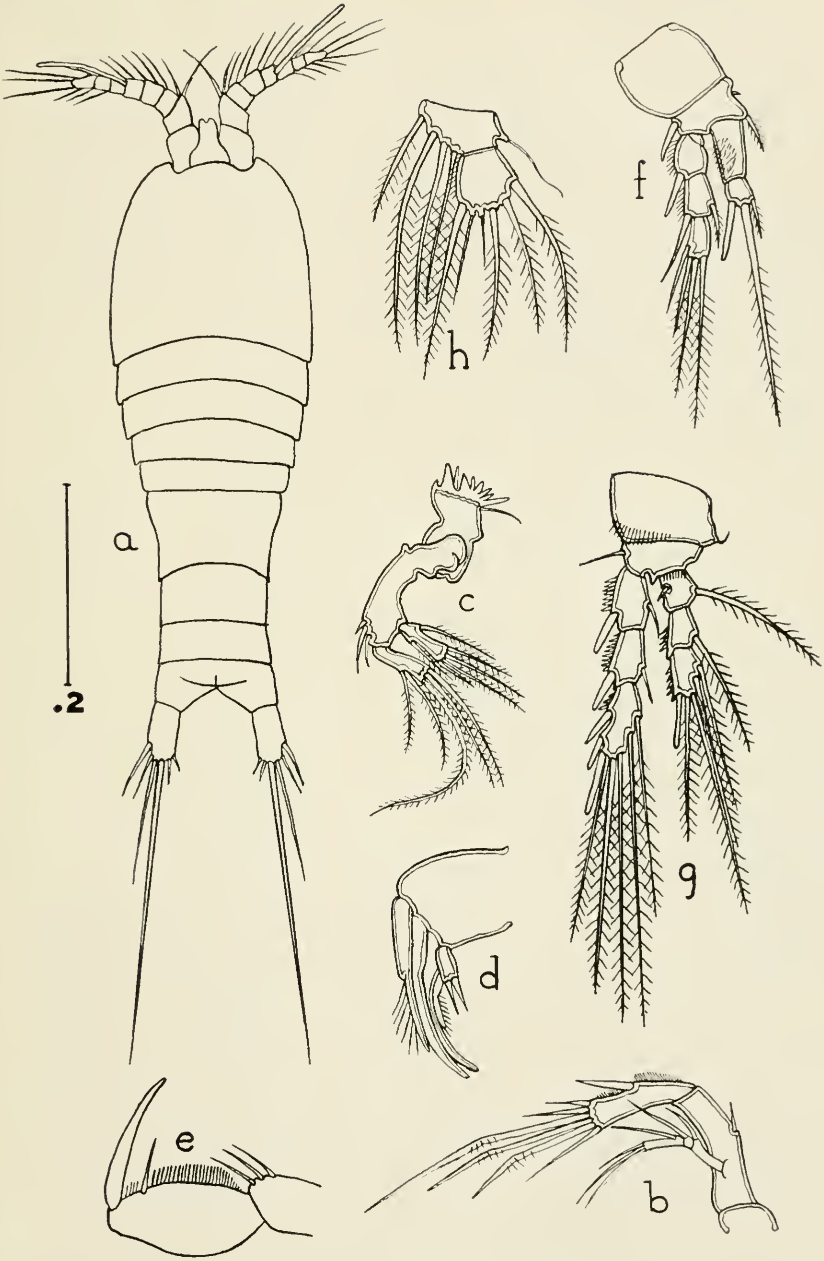
CHAPPAQUIDDICKA PULCHELLA, NEW GENUS, NEW SPECIES

a, Male, dorsal; b, female, first antenna; *c*, male, first antenna; *d*, second antenna; *e*, first maxilla; *f*, second maxilla; *g*, maxilliped; *h*, *i*, *j*, *k*, first, second, third, and fourth legs; *l*, fifth leg; *m*, male, fifth leg; *o*, male, sixth leg; *p*, male, mandible and palp.



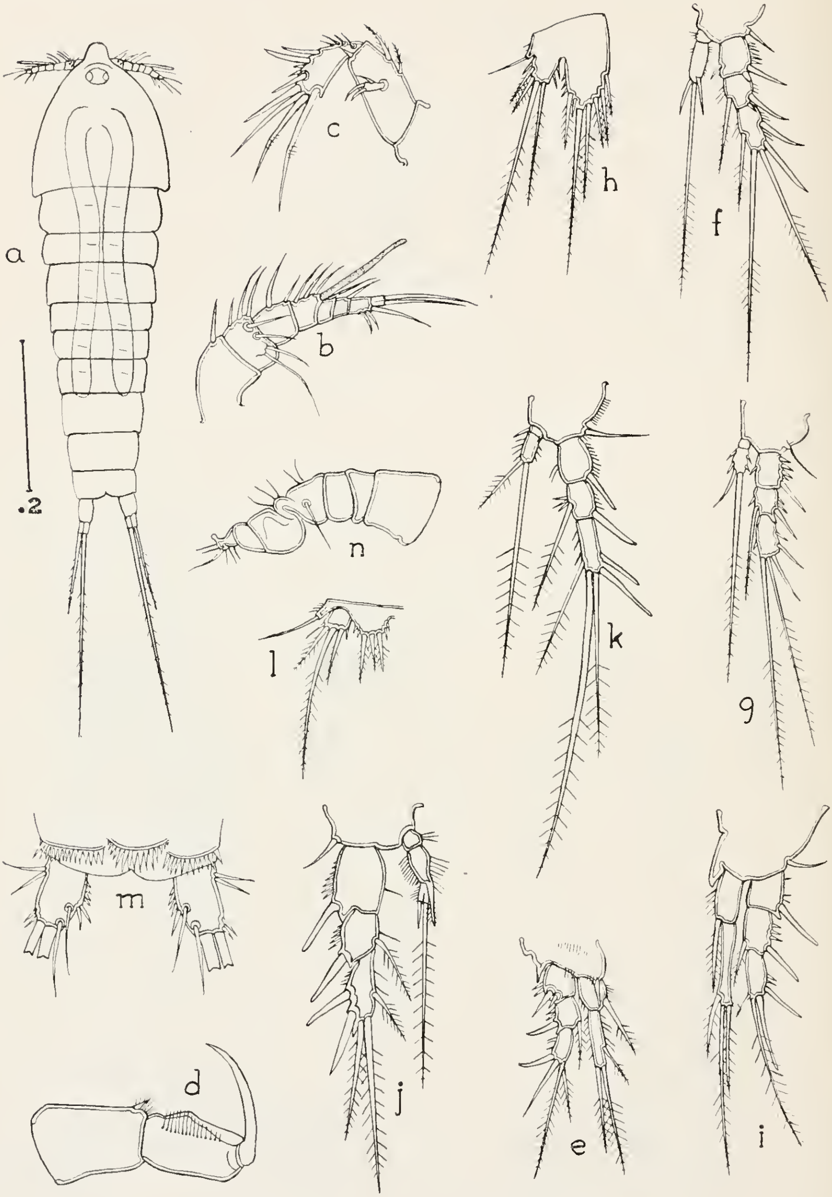
AMPHIASCUS DACTYLIFER, NEW SPECIES

a, Female, dorsal; *b*, female urosome, lateral, showing spermatophore; *c*, female, fifth leg; *d*, female, first leg; *e*, male, first antenna; *f*, male, first leg; *g*, male, second leg; *h*, male, fifth leg.



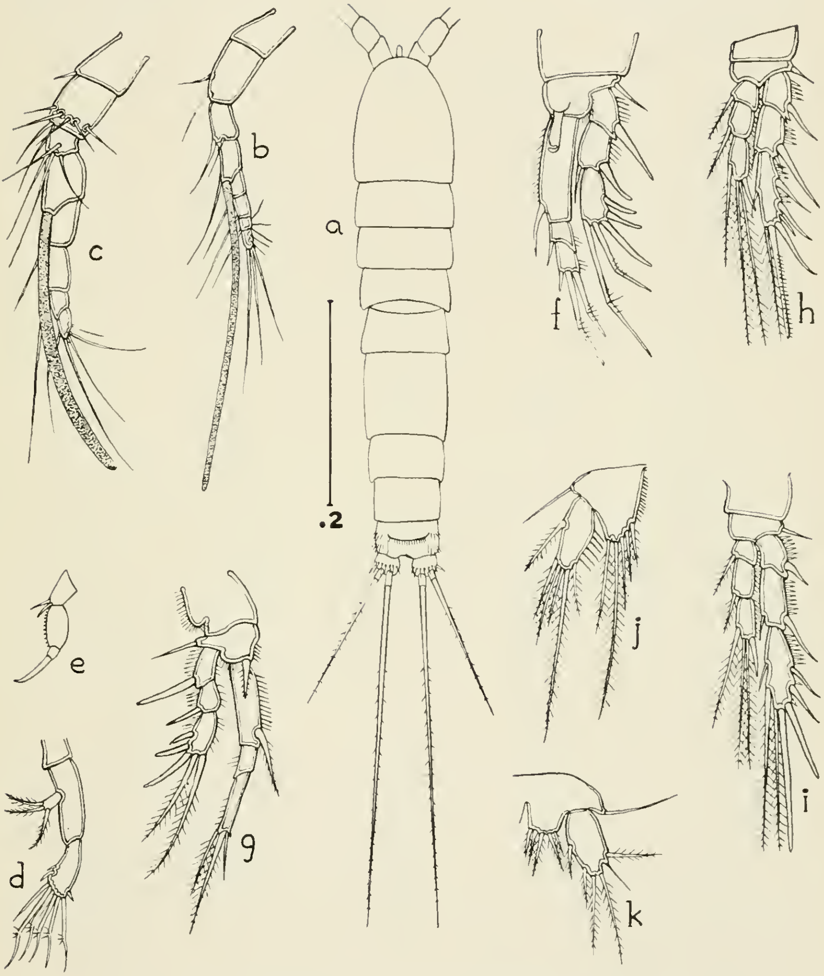
STENHELIA ARENICOLA, NEW SPECIES

a, Female, dorsal; *b*, second antenna; *c*, mandible with palp; *d*, second maxilla; *e*, maxilliped; *f*, first leg; *g*, fourth leg; *h*, fifth leg.



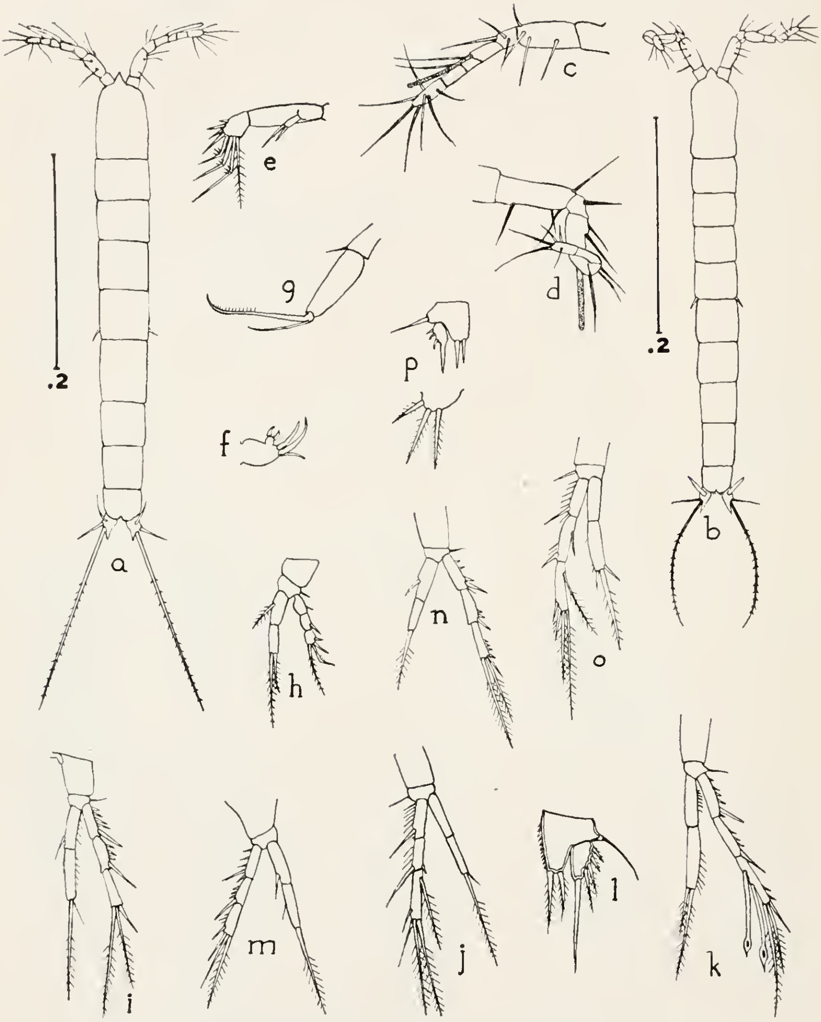
ATTHEYELLA BICOLOR, NEW SPECIES

a, Female, dorsal; *b*, first antenna; *c*, second antenna; *d*, maxilliped; *e*, first leg; *f*, third leg; *g*, fourth leg; *h*, fifth leg; *i*, male, first leg; *j*, third leg; *k*, fourth leg; *l*, fifth leg; *m*, caudal rami; *n*, first antenna.



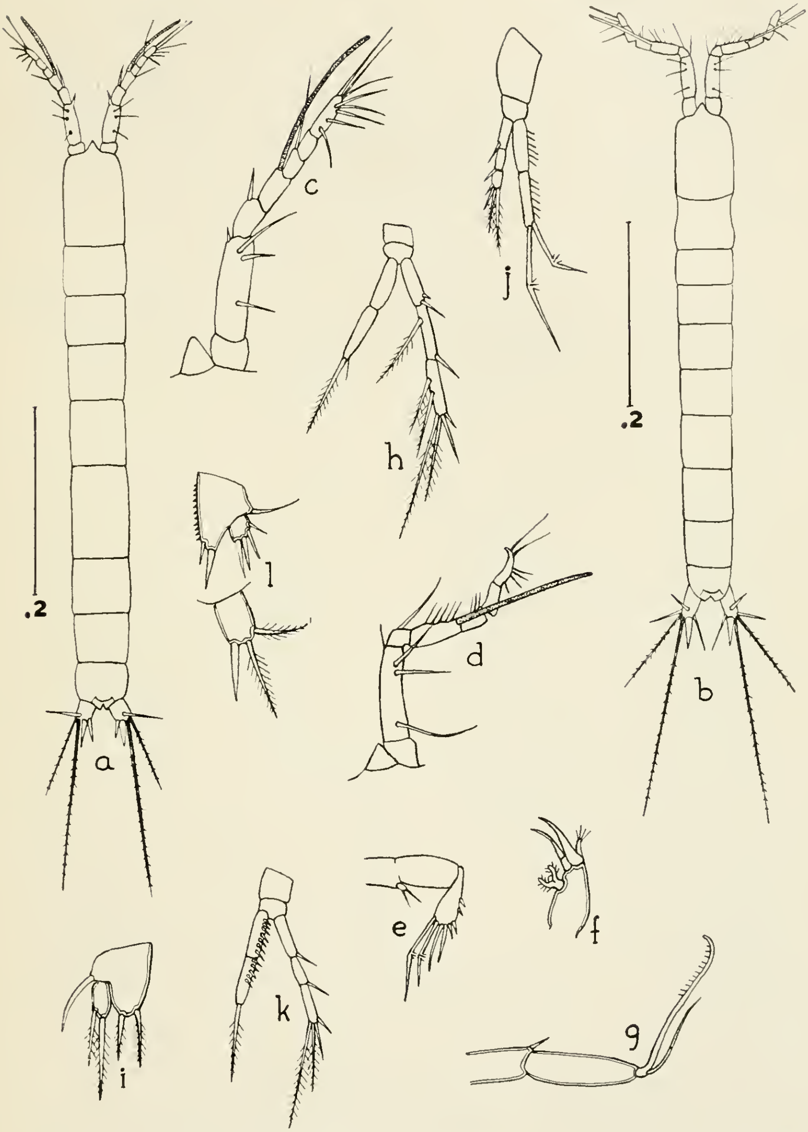
NITOCRA CHELIFER, NEW SPECIES

a, Female, dorsal; *b*, female, first antenna; *c*, male, first antenna; *d*, second antenna; *e*, maxilliped; *f*, male, first leg; *g*, female, first leg; *h*, second leg; *i*, fourth leg; *j*, fifth leg; *k*, male, fifth leg.



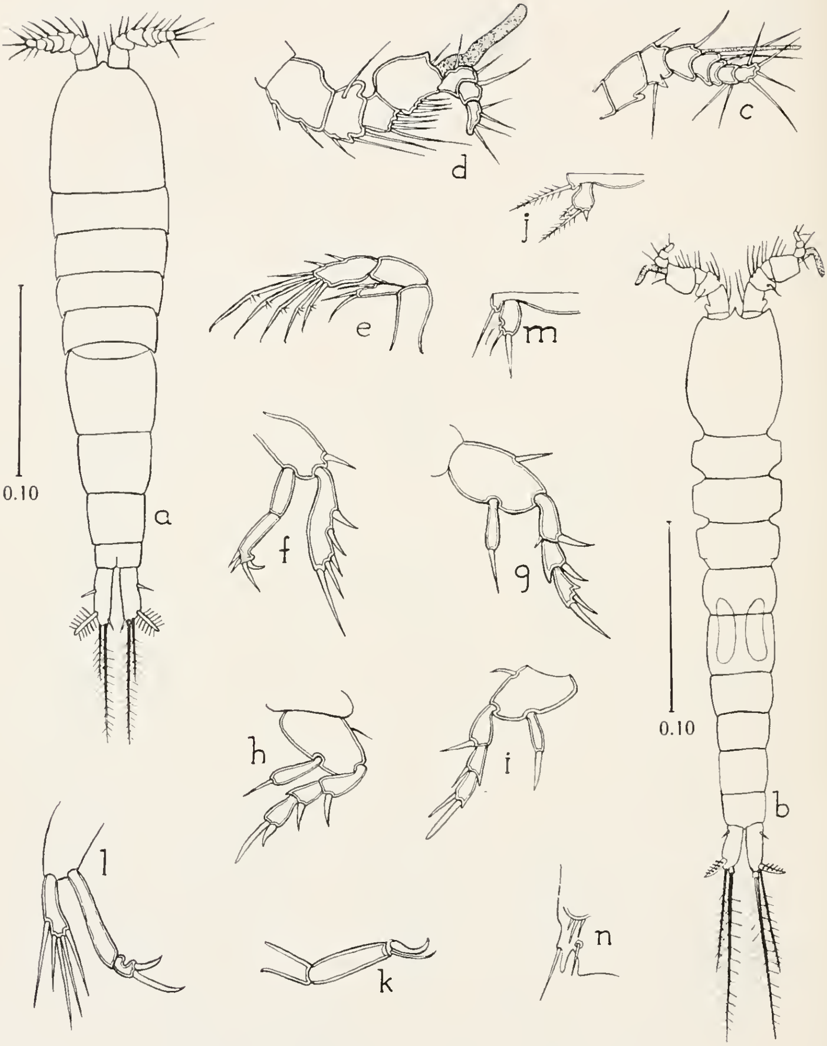
Paraleptastacus brevicaudatus, New Genus, New Species

a, Female, dorsal; *b*, male, dorsal, *c*, female, first antenna; *d*, male, first antenna; *e*, second antenna; *f*, second maxilla; *g*, maxilliped; *h*, female, first leg; *i*, *j*, *k*, *l*, second, third, fourth, and fifth legs; *m*, *n*, *o*, *p*, male, second, third, fourth, and fifth and sixth legs.



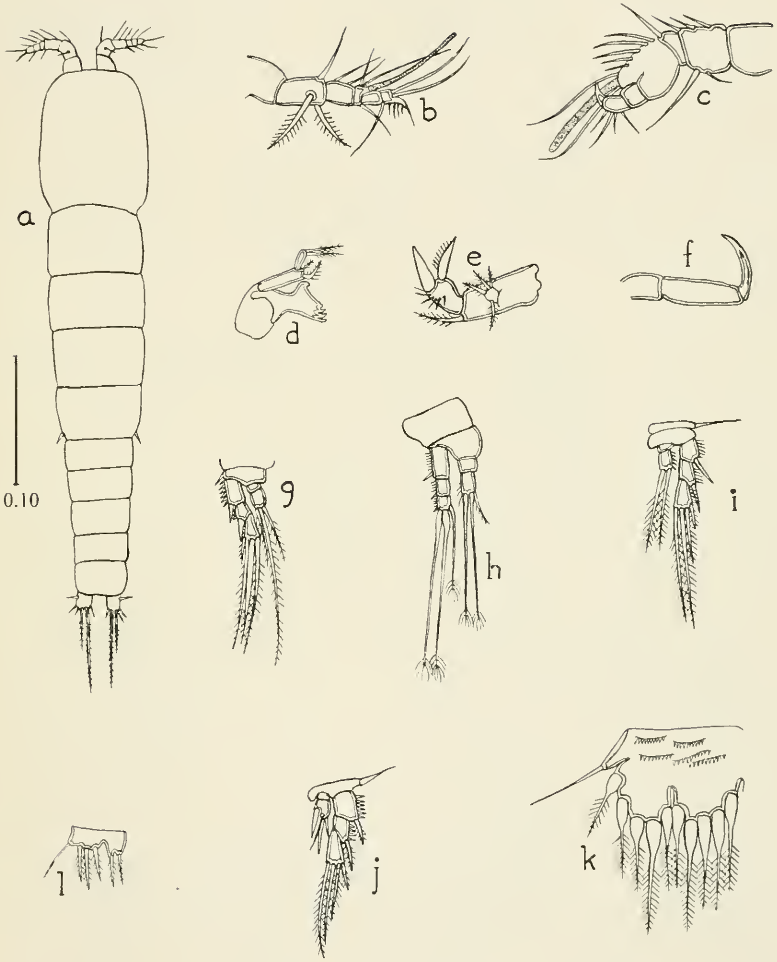
PARALEPTASTACUS KATAMENSIS, NEW SPECIES

a, Female, dorsal; *b*, male, dorsal; *c*, female, first antenna; *d*, male, first antenna; *e*, second antenna; *f*, second maxilla; *g*, maxilliped; *h*, female, fourth leg; *i*, female, fifth leg; *j*, male, first leg; *k*, male, second leg; *l*, male, fifth and sixth legs.



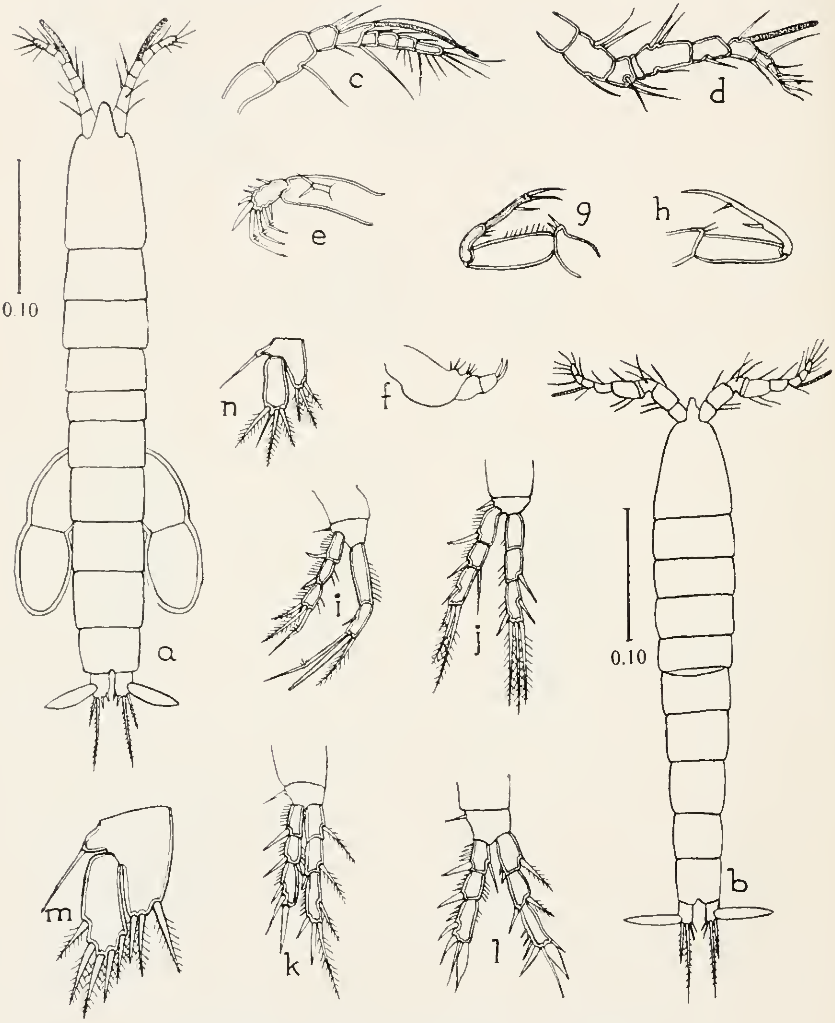
EMERTONIA GRACILIS, NEW GENUS, NEW SPECIES

a, Female, dorsal; *b*, male, dorsal; *c*, female, first antenna; *d*, male, first antenna; *e*, second antenna; *f*, *g*, *h*, *i*, *j*, female, first, second, third, fourth, and fifth legs; *k*, male, maxilliped; *l*, *m*, *n*, first, fifth, and sixth legs.



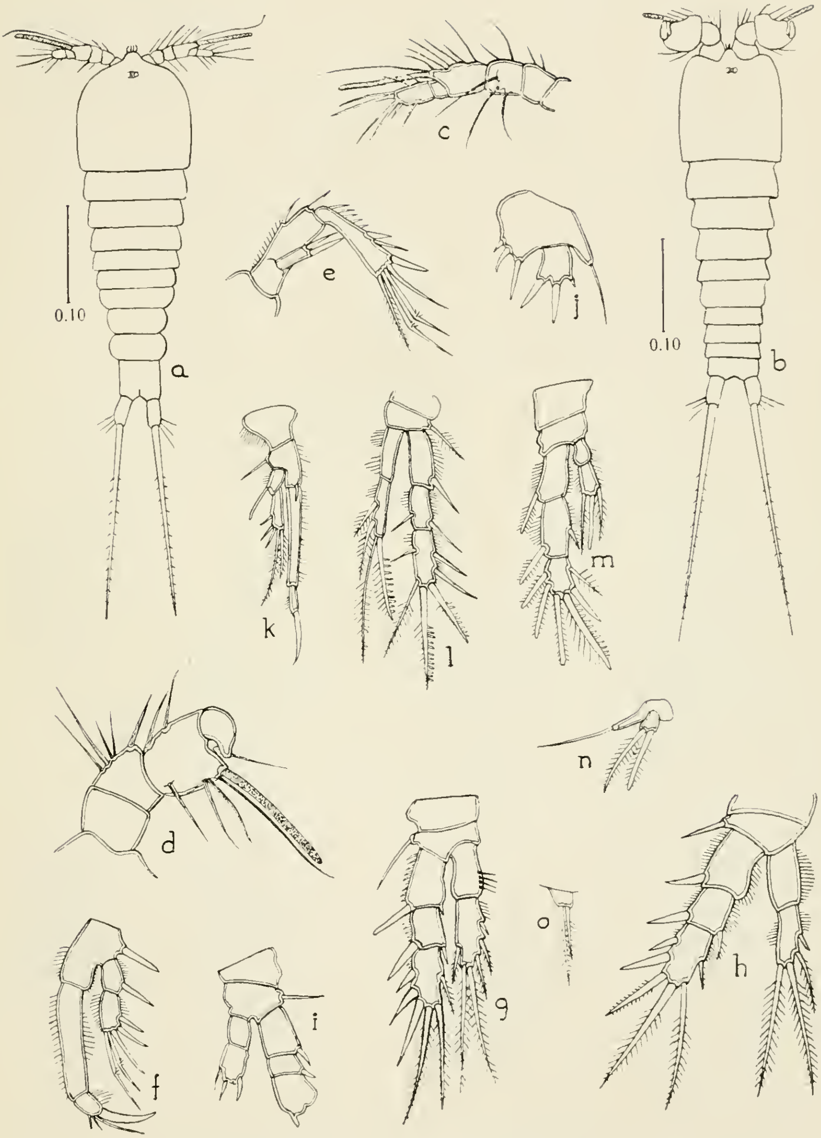
QUINTANUS TENELLUS, NEW GENUS, NEW SPECIES

a, Female, dorsal; *b*, female, first antenna; *c*, male, first antenna; *d*, mandible and palp; *e*, second antenna; *f*, maxilliped; *g*, *h*, *i*, *j*, *k*, female, first, second, third, fourth, and fifth legs; *l*, male, fifth leg.



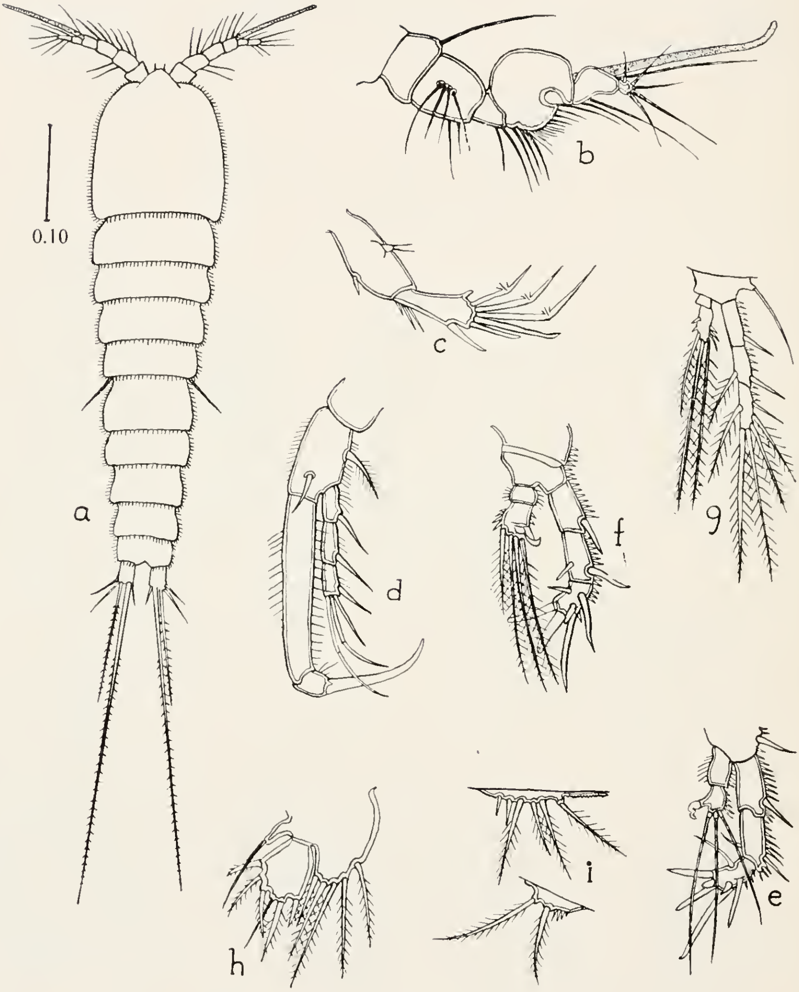
GOFFINELLA STYLIFER, NEW GENUS, NEW SPECIES

a, Female, dorsal; *b*, male, dorsal; *c*, female, first antenna, *d*, male, first antenna; *e*, second antenna; *f*, second maxilla; *g*, female, maxilliped; *h*, male, maxilliped; *i*, *j*, *k*, *l*, *m*, female, first, second, third fourth, and fifth legs; *n*, male, fifth leg.



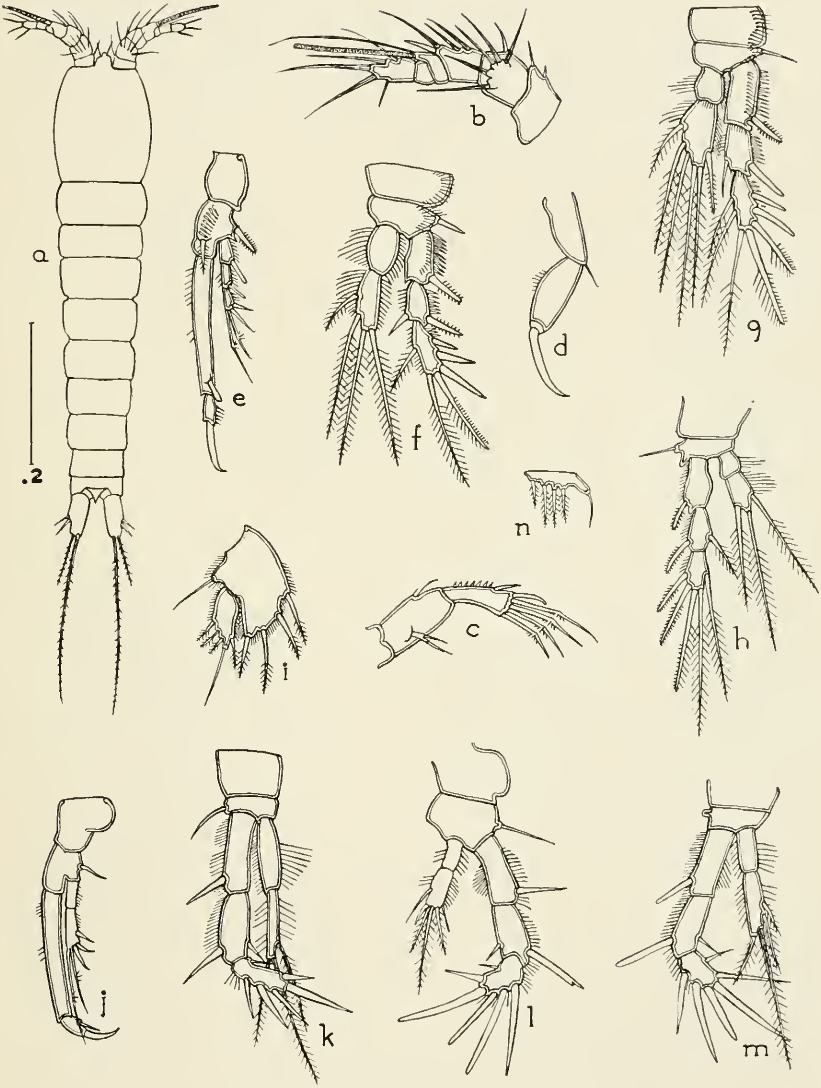
LAOPHONTE TALIPES, NEW SPECIES

a, Female, dorsal; *b*, male, dorsal; *c*, female, first antenna; *d*, male, first antenna; *e*, second antenna; *f*, *g*, *h*, *i*, *j*, female, first, second, third, fourth, and fifth legs; *k*, *l*, *m*, *n*, *o*, male, first, second, fourth, fifth, and sixth legs.



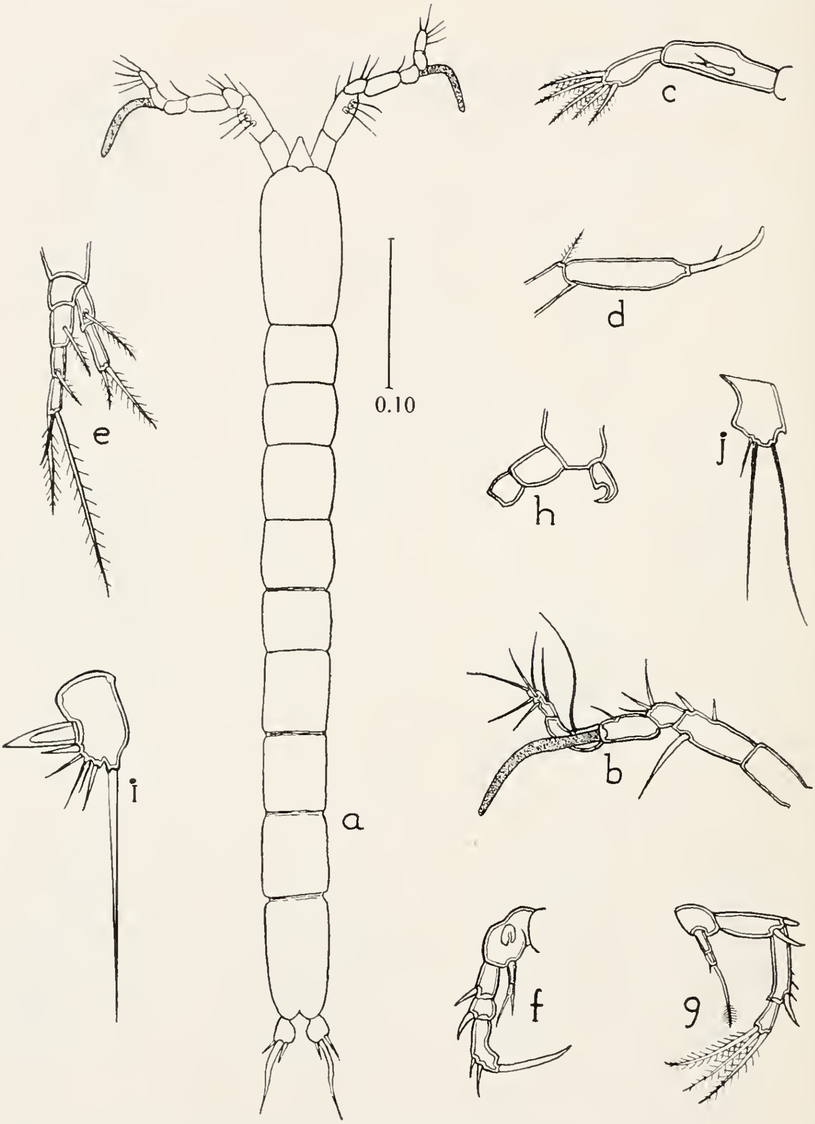
Laophonte manifera, New Species

a, Female, dorsal; *b*, male, first antenna; *c*, second antenna; *d*, female, first leg; *e*, *f*, *g*, male, second, third, and fourth legs; *h*, female, fifth leg; *i*, male, fifth and sixth legs.



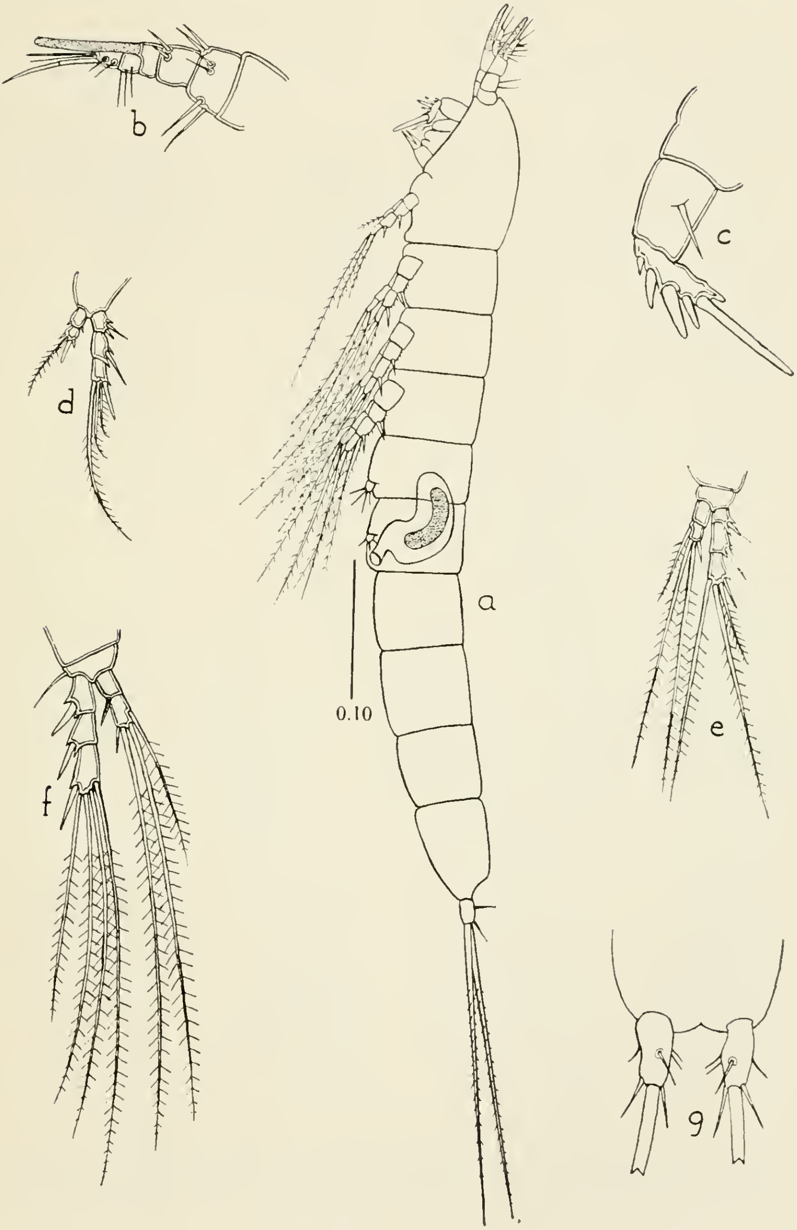
LAOPHONTE CAPILLATA, NEW SPECIES

a, Female, dorsal; *b*, first antenna; *c*, second antenna; *d*, maxilliped; *e, f, g, h, i*, first, second, third, fourth, and fifth legs; *j, k, l, m, n*, male, first, second, third, fourth, and fifth legs.



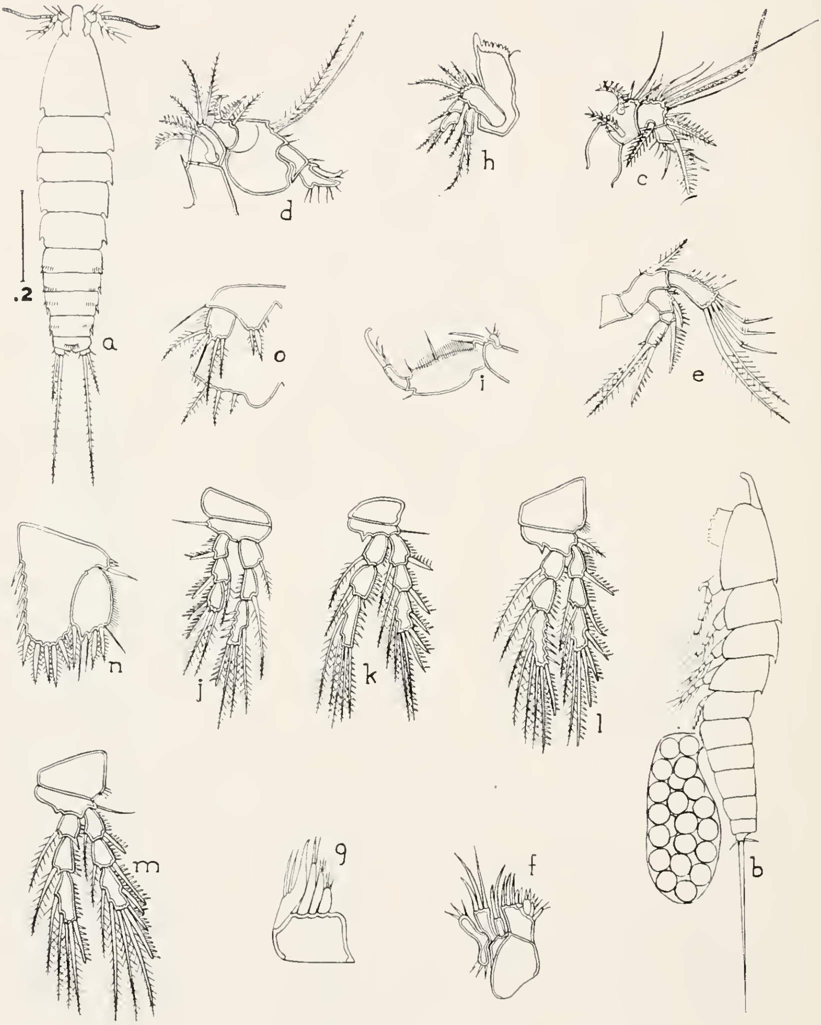
STENOCARIS ARENICOLA, NEW SPECIES

a, Male, dorsal; *b*, first antenna; *c*, second antenna; *d*, maxilliped; *e*, *f*, *g*, first, second, and fourth legs; *h*, basipod of second leg, with chela on its anterior surface; *i*, fifth leg; *j*, sixth leg.



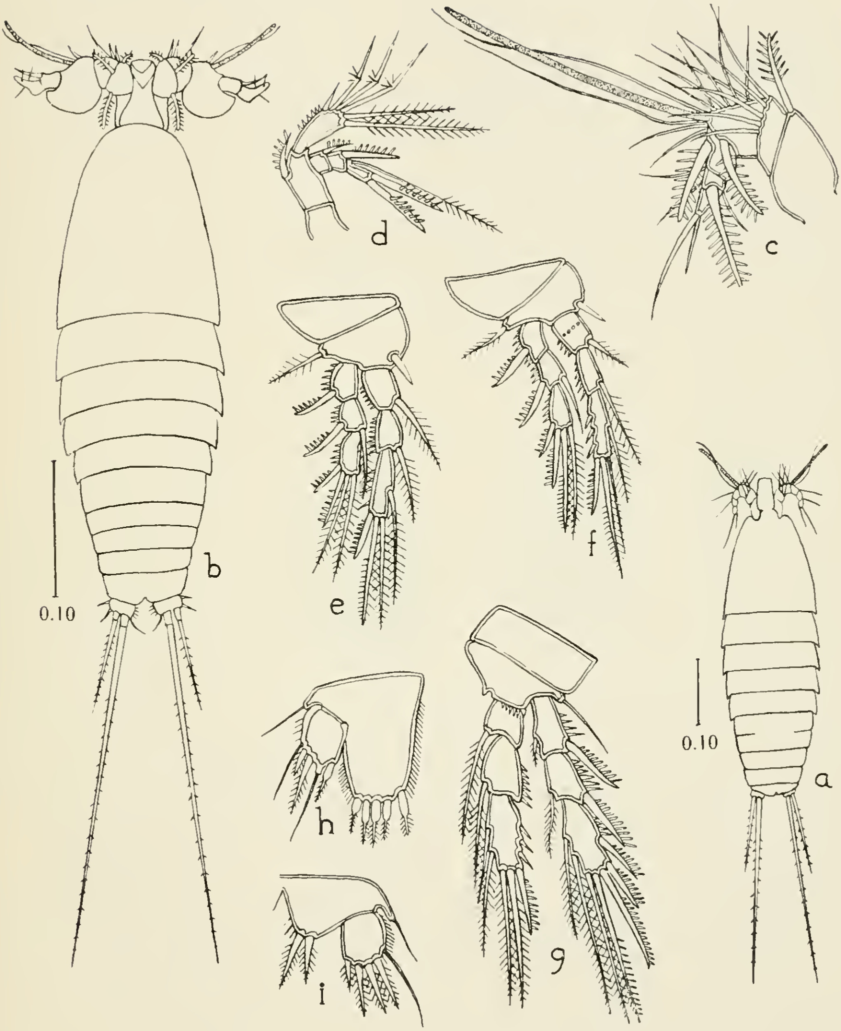
D'ARCYTHOMPSONIA PARVA, NEW SPECIES

a, Male, lateral; *b*, first antenna; *c*, second antenna; *d*, *e*, *f*, first, second, and fourth legs; *g*, caudal rami.



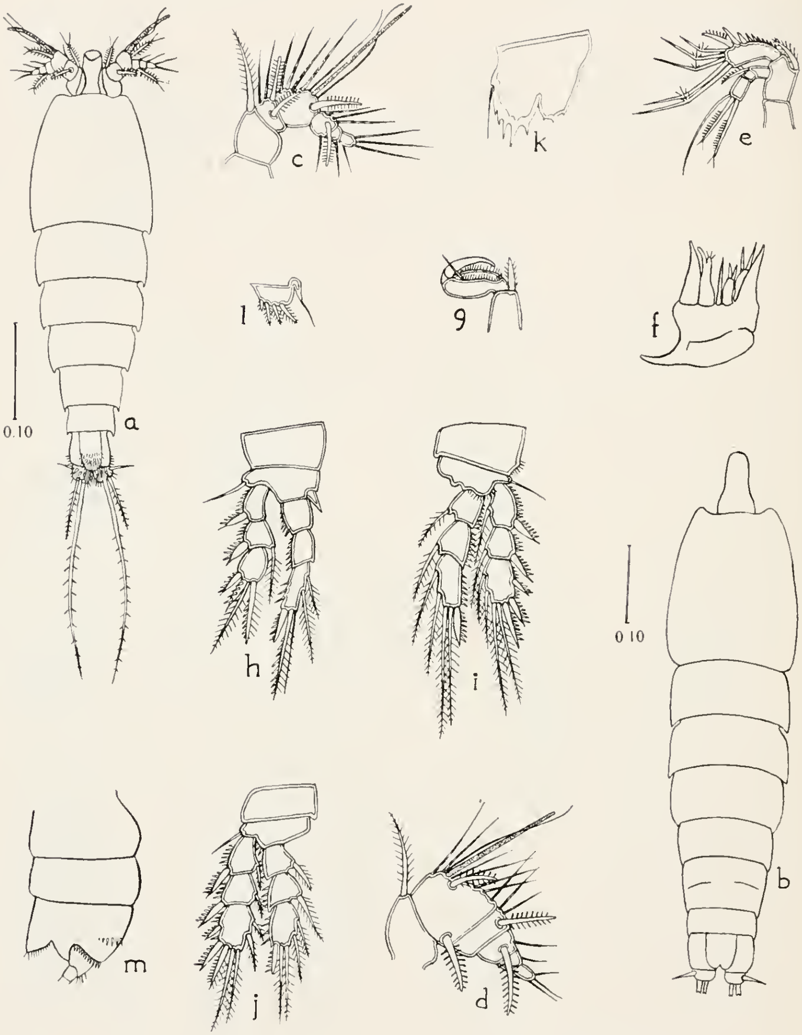
RATHBUNULA AGILIS, NEW GENUS, NEW SPECIES

a, Female, dorsal; *b*, female, lateral; *c*, female, first antenna; *d*, male, first antenna; *e*, second antenna; *f*, first maxilla; *g*, second maxilla; *h*, mandible and palp; *i*, maxilliped; *j*, *k*, *l*, *m*, *n*, female, first, second, third, fourth, and fifth legs; *o*, fifth and sixth legs of male.



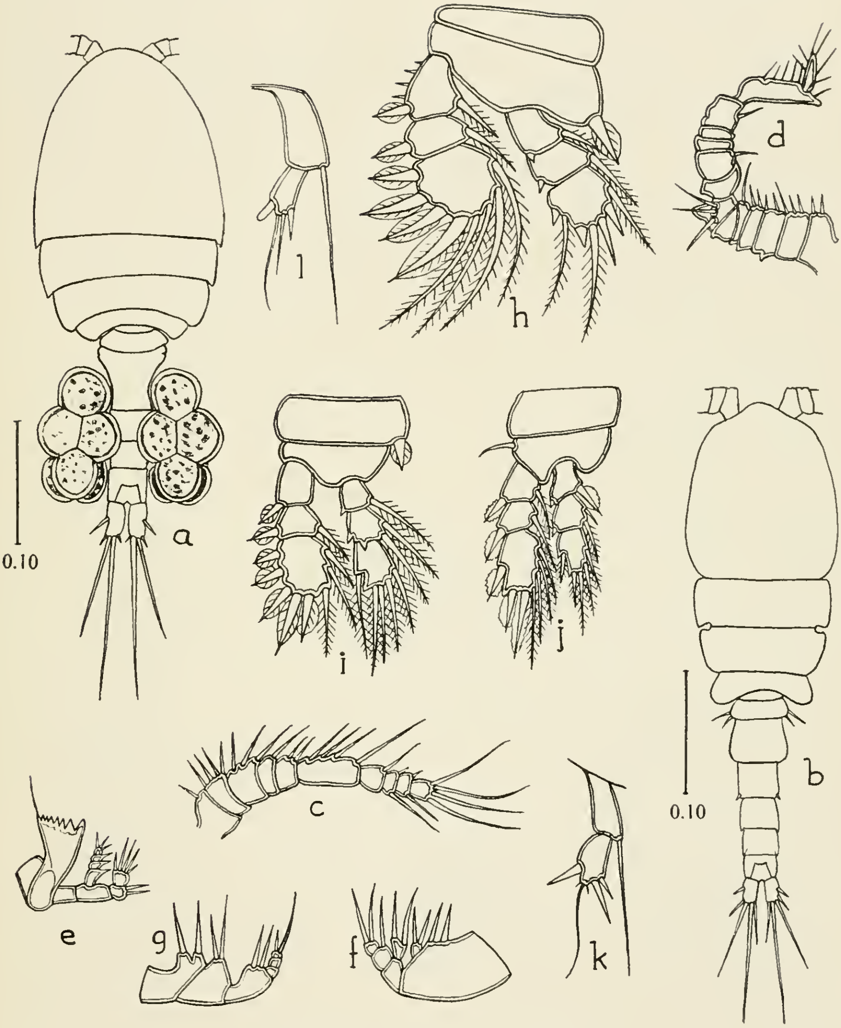
RATHBUNULA CURTICAUDA, NEW SPECIES

a, Female, dorsal; *b*, male, dorsal; *c*, female, first antenna; *d*, second antenna; *e*, *f*, *g*, *h*, first, second, fourth, and fifth legs; *i*, male, fifth leg.



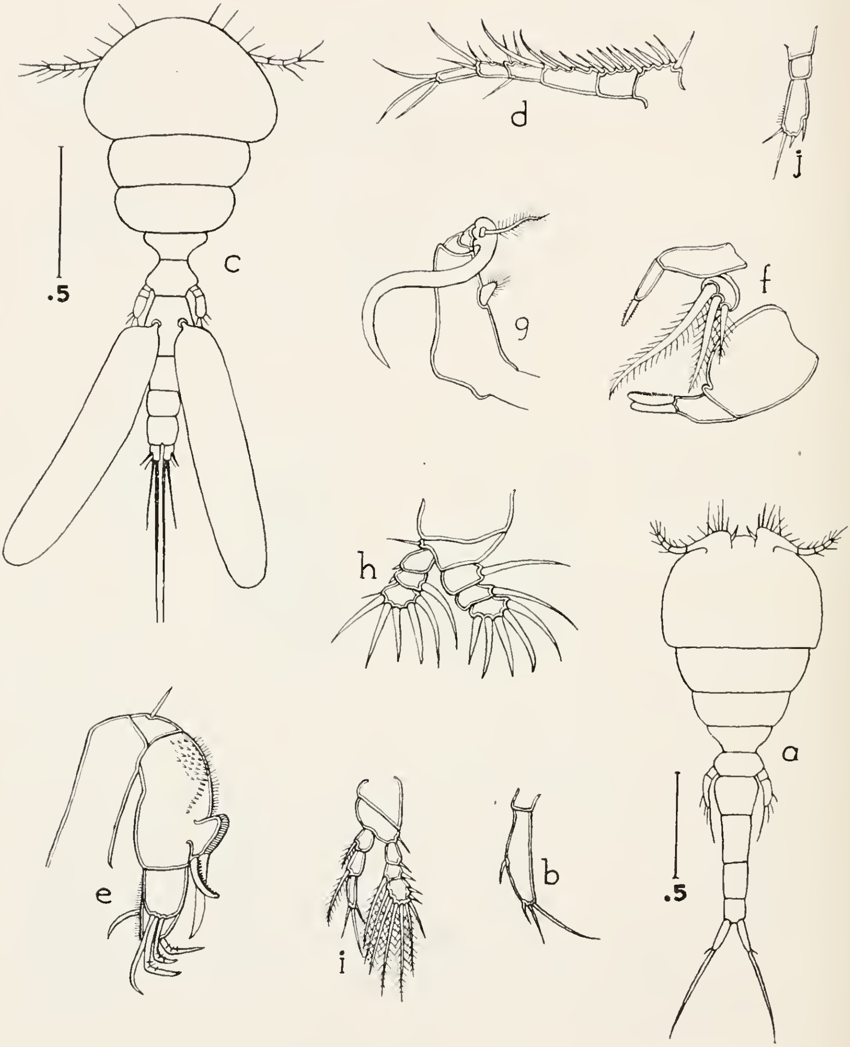
ECHINOCORNUS PECTINATUS, NEW GENUS, NEW SPECIES

a, Female, dorsal; *b*, male, dorsal; *c*, female, first antenna; *d*, male, first antenna; *e*, second antenna; *f*, maxilla; *g*, maxilliped; *h*, *i*, *j*, *k*, female, first, second, fourth, and fifth legs; *l*, male, fifth leg; *m*, urosome, lateral.



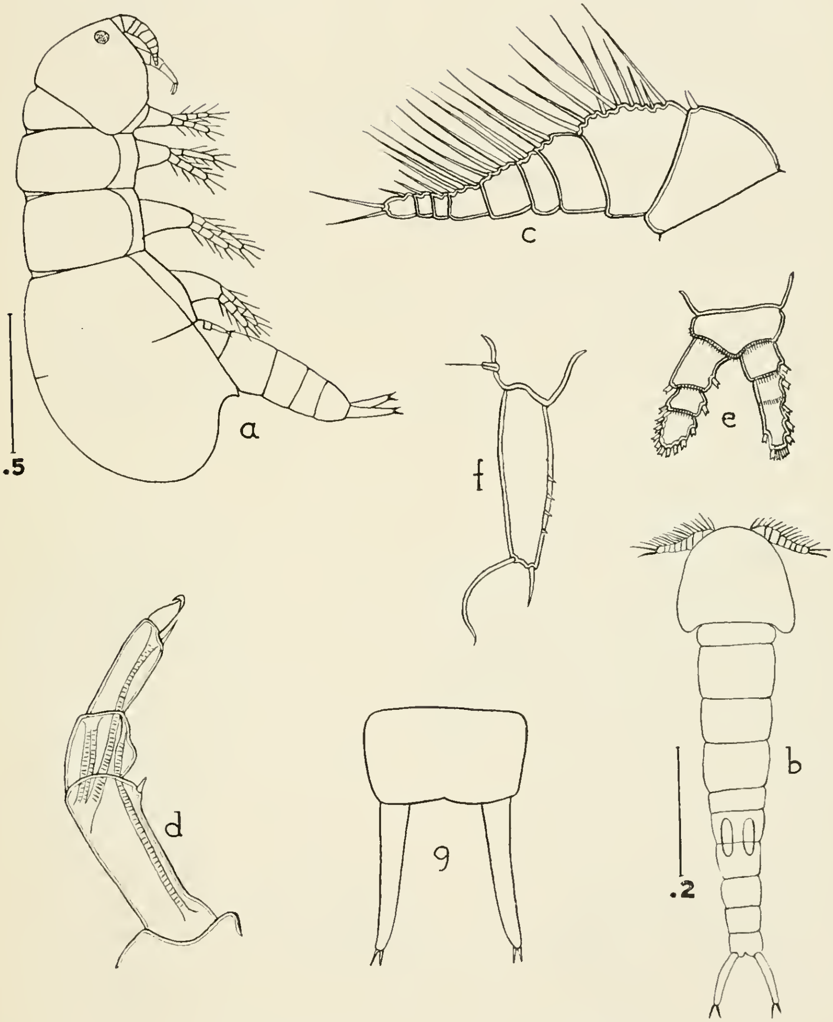
CYCLOPINA AGILIS, NEW SPECIES

a, Female, dorsal; *b*, male, dorsal; *c*, female, first antenna; *d*, male, first antenna; *e*, mandible and palp; *f*, second maxilla; *g*, maxilliped; *h*, *i*, *j*, *k*, female, first, second, fourth, and fifth legs; *l*, male, fifth leg.



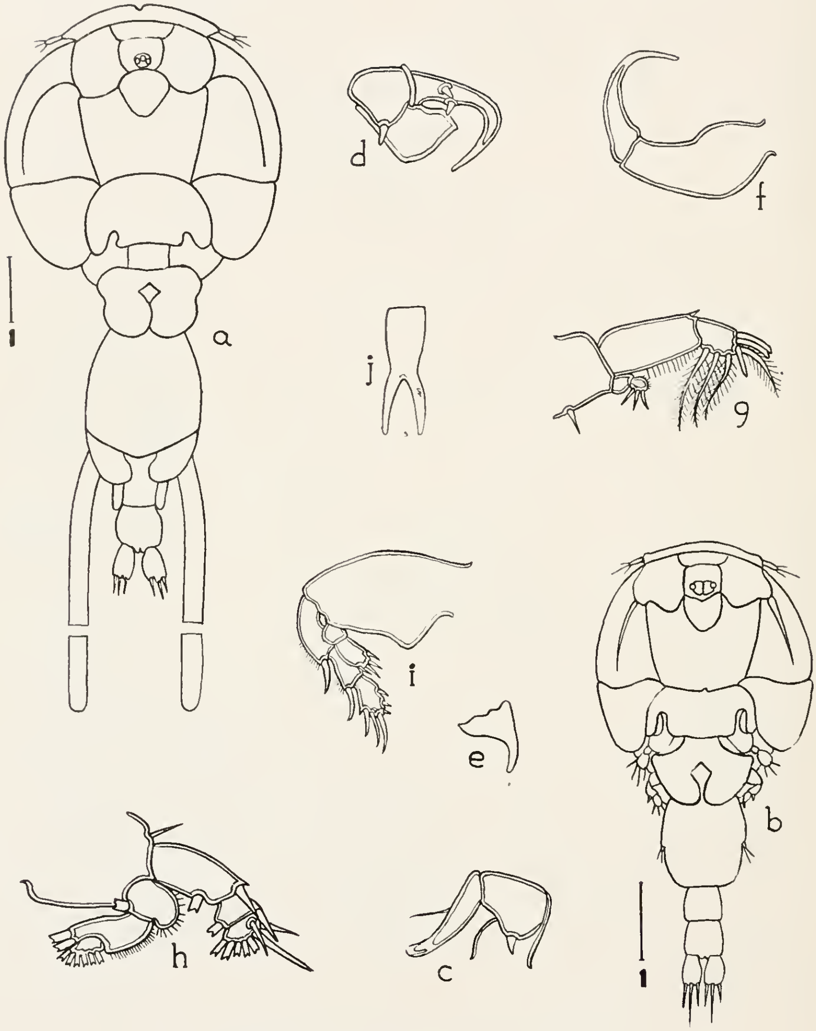
BOMOLOCHUS

Bomolochus teres: *a*, Female, dorsal; *b*, fifth leg.
Bomolochus albidus, new species: *c*, Female, dorsal; *d*, first antenna; *e*, second antenna; *f*, mandible, first and second maxillae; *g*, maxilliped; *h*, first leg; *i*, fourth leg; *j*, fifth leg.



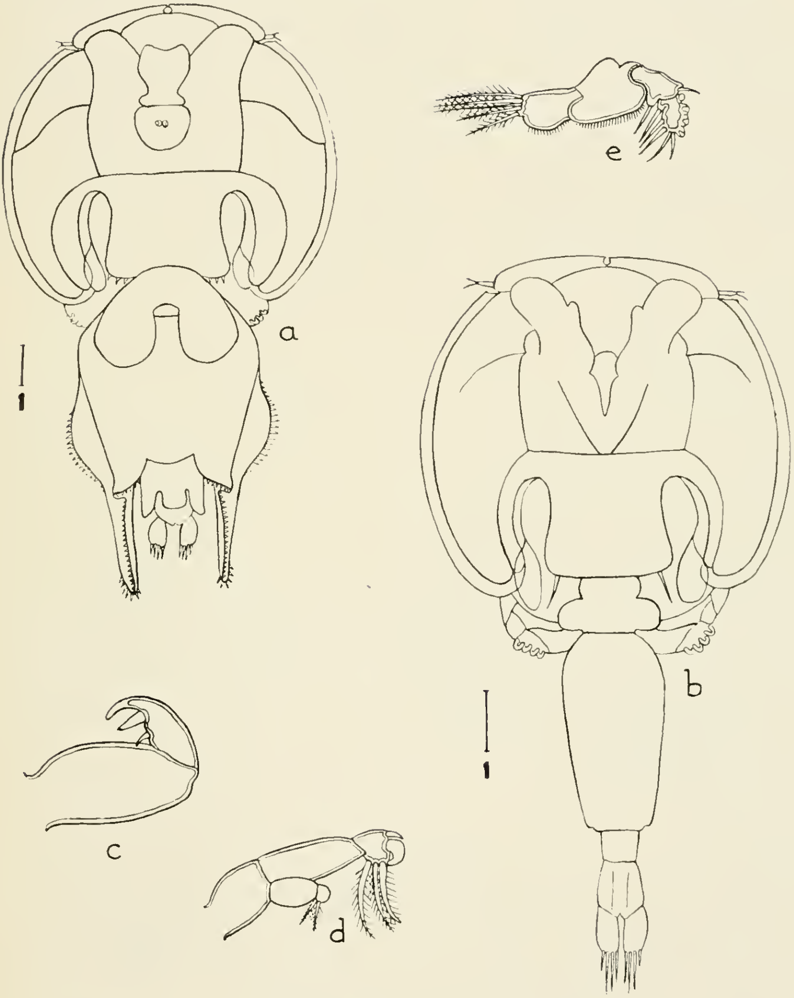
DOROPYGUS LATICORNIS, NEW SPECIES

a, Female, lateral; *b*, male, dorsal; *c*, female, first antenna; *d*, second antenna; *e*, second leg; *f*, fifth leg; *g*, anal segment and caudal rami.



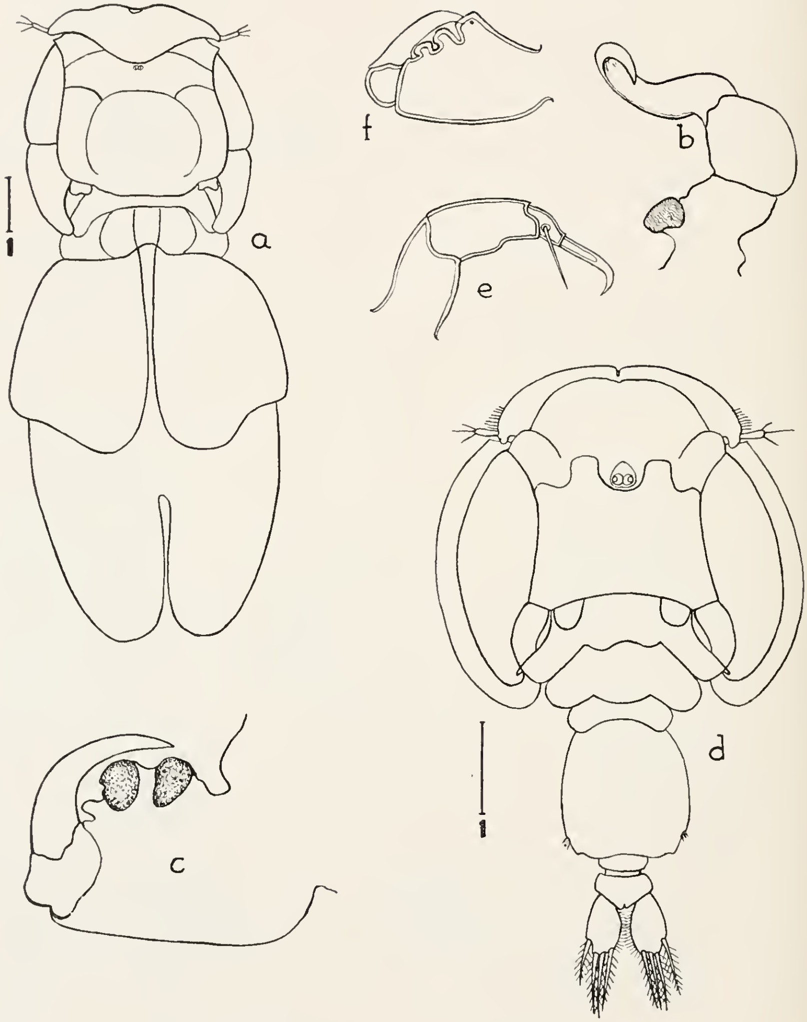
ELYTROPHORA ATLANTICA, NEW SPECIES

a, Female, dorsal; *b*, male, dorsal; *c*, female, second antenna; *d*, male, second antenna; *e*, maxilla; *f*, maxilliped; *g*, female, first leg; *h*, second leg; *i*, fourth leg.



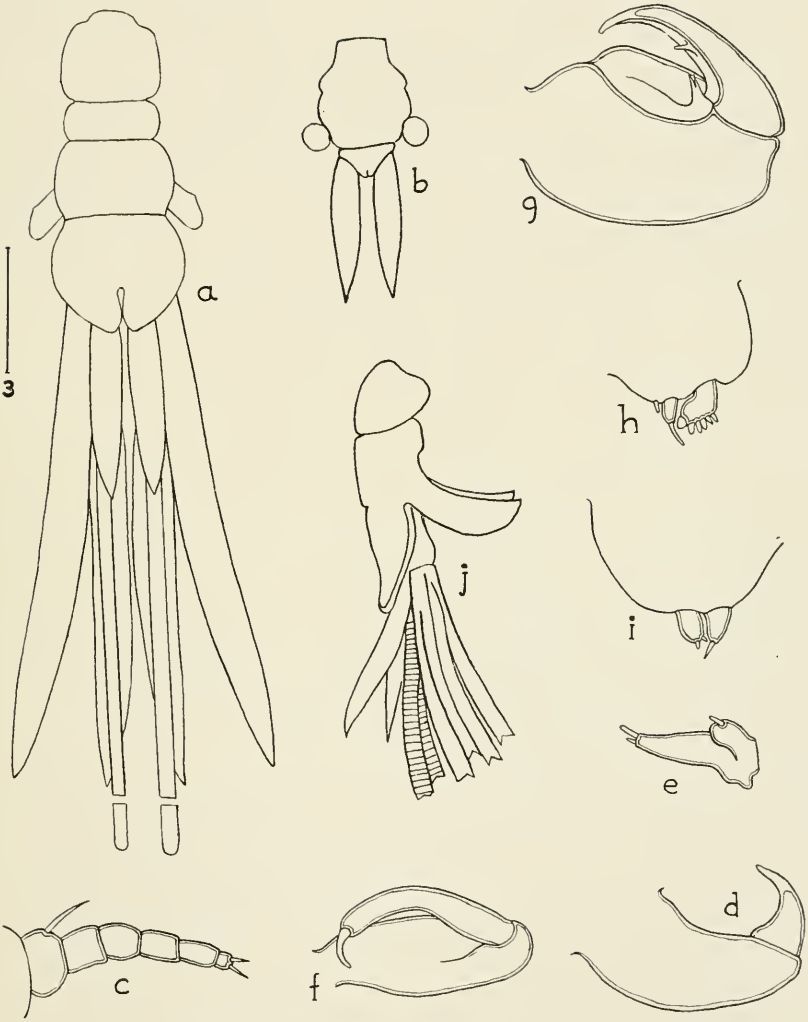
ALEBION CRASSUS, NEW SPECIES

,Female, dorsal; *b*, male, dorsal; *c*, maxilliped; *d*, first leg; *e*, second leg.



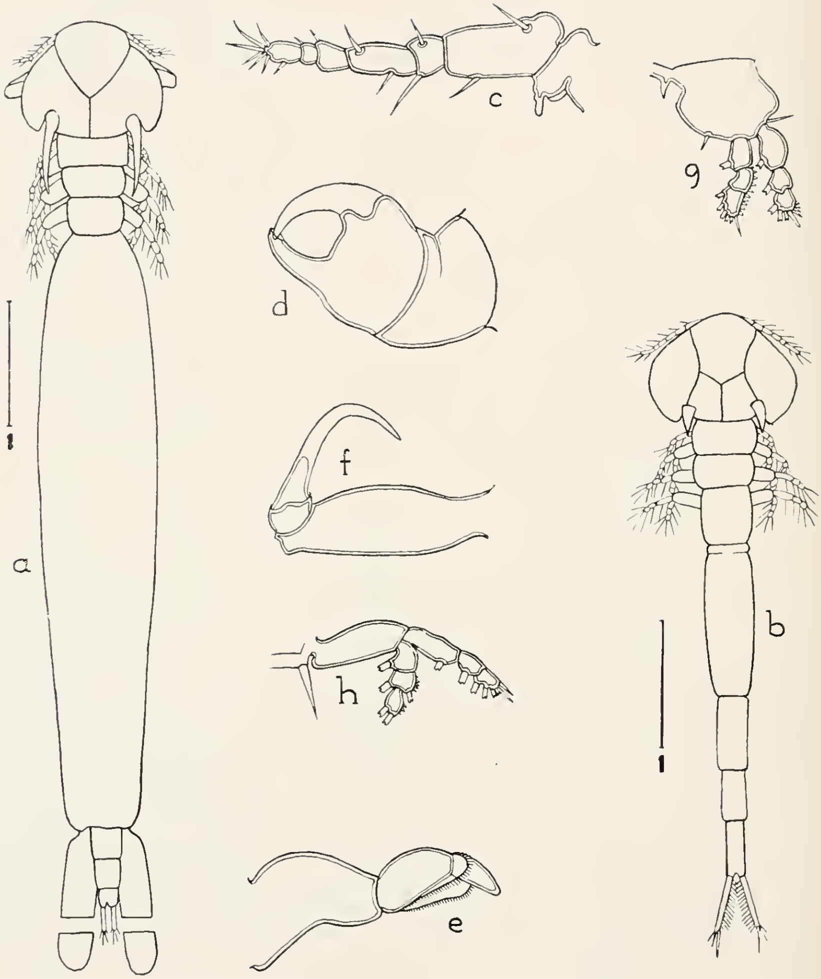
ECHTHROGALEUS COLEOPTRATUS

a, Female, dorsal; *b*, second antenna; *c*, maxilliped; *d*, male, dorsal; *e*, second antenna; *f*, maxilliped.



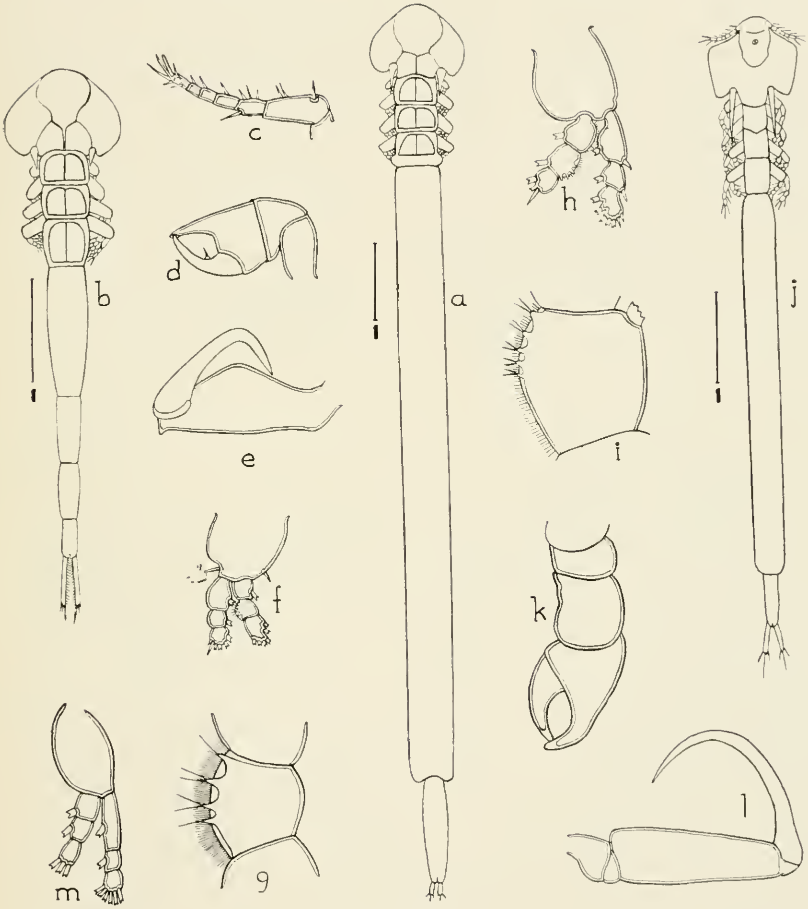
LERNANTHROPUS LONGIPES, NEW SPECIES

a, Female, dorsal; *b*, urosome, showing caudal rami and spermatophores; *c*, first antenna; *d*, second antenna; *e*, first maxilla; *f*, second maxilla; *g*, maxilliped; *h*, first legs; *i*, second legs; *j*, female, lateral.



KRØYERIA GRACILIS, NEW SPECIES

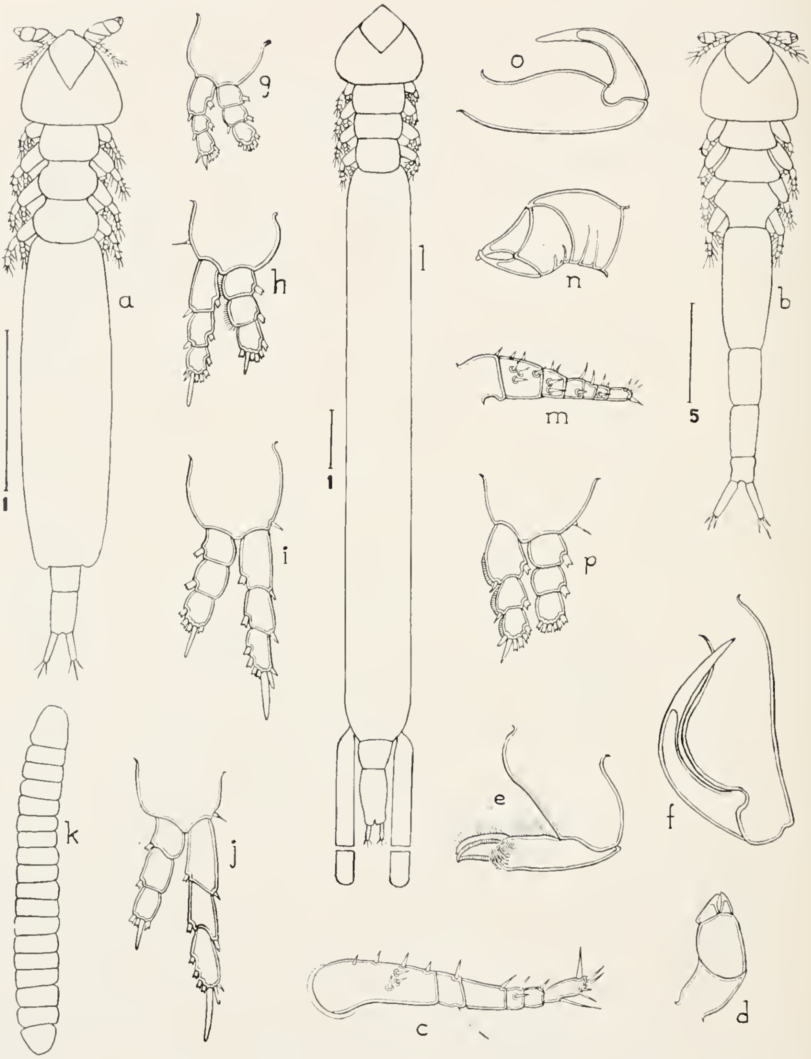
a, Female, dorsal; *b*, male, dorsal; *c*, first antenna; *d*, second antenna; *e*, second maxilla; *f*, maxilliped; *g*, female, first leg; *h*, male, fourth leg.



KRØYERIA

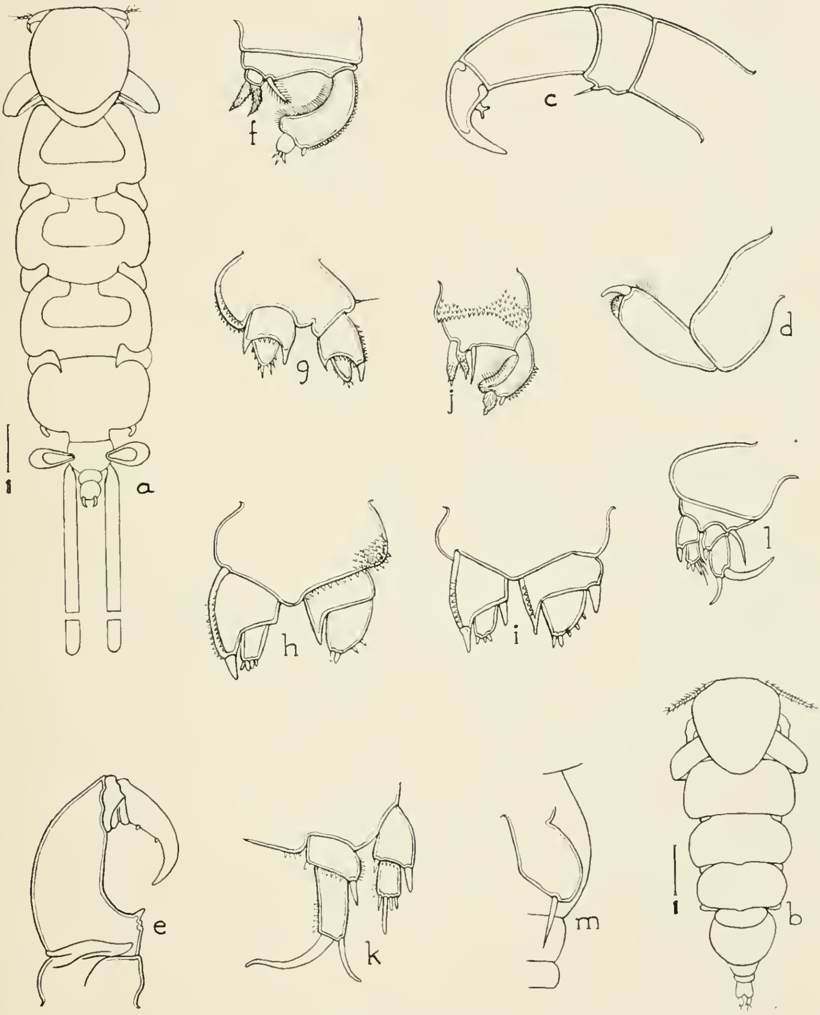
Krøyeria papillipes, new species: *a*, Female, dorsal; *b*, male, dorsal; *c*, first antenna; *d*, second antenna; *e*, maxilliped; *f*, female, first leg; *g*, papillae on middle endopod segment; *h*, fourth leg; *i*, papillae on middle endopod segment.

Krøyeria lineata: *j*, Female, dorsal; *k*, second antenna; *l*, maxilliped; *m*, first leg.



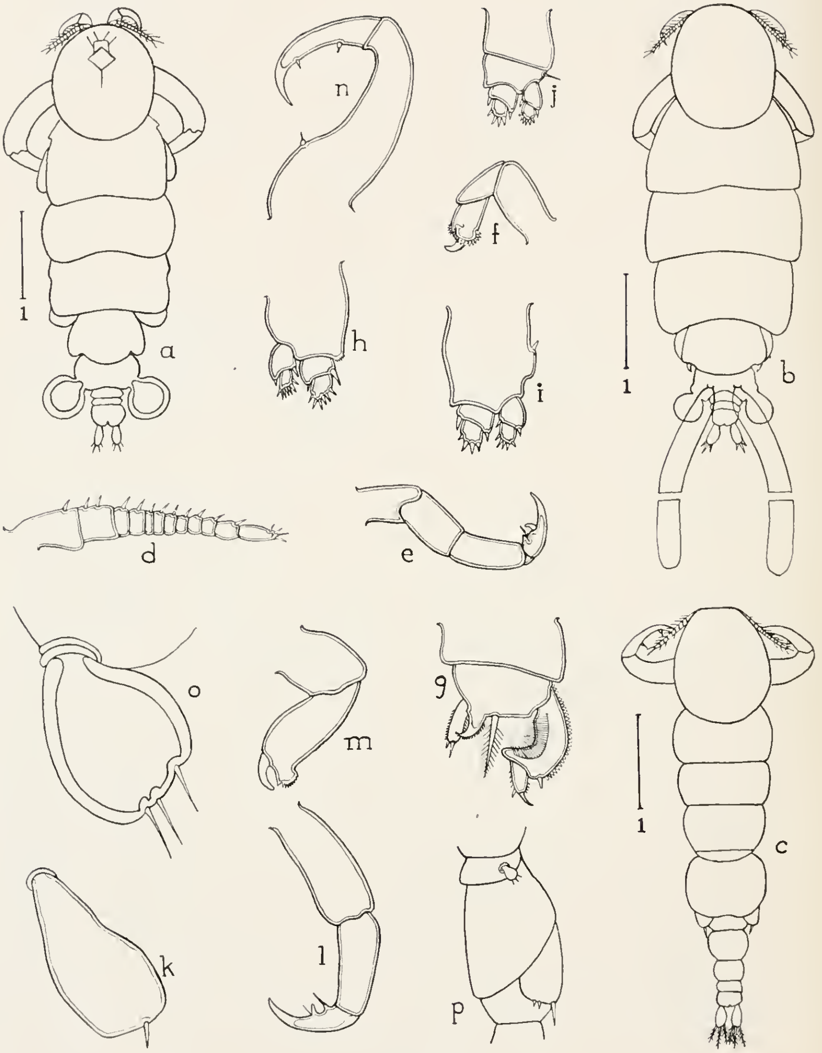
KRØYERINA, NEW GENUS

Krøyerina nasuta, new species: *a*, Female, dorsal; *b*, male, dorsal; *c*, first antenna; *d*, second antenna; *e*, second maxilla; *f*, maxilliped; *g*, *h*, *i*, *j*, first, second, third, and fourth legs; *k*, egg string.
Krøyerina elongata, new species: *l*, Female, dorsal; *m*, first antenna; *n*, second antenna; *o*, maxilliped; *p*, first leg.



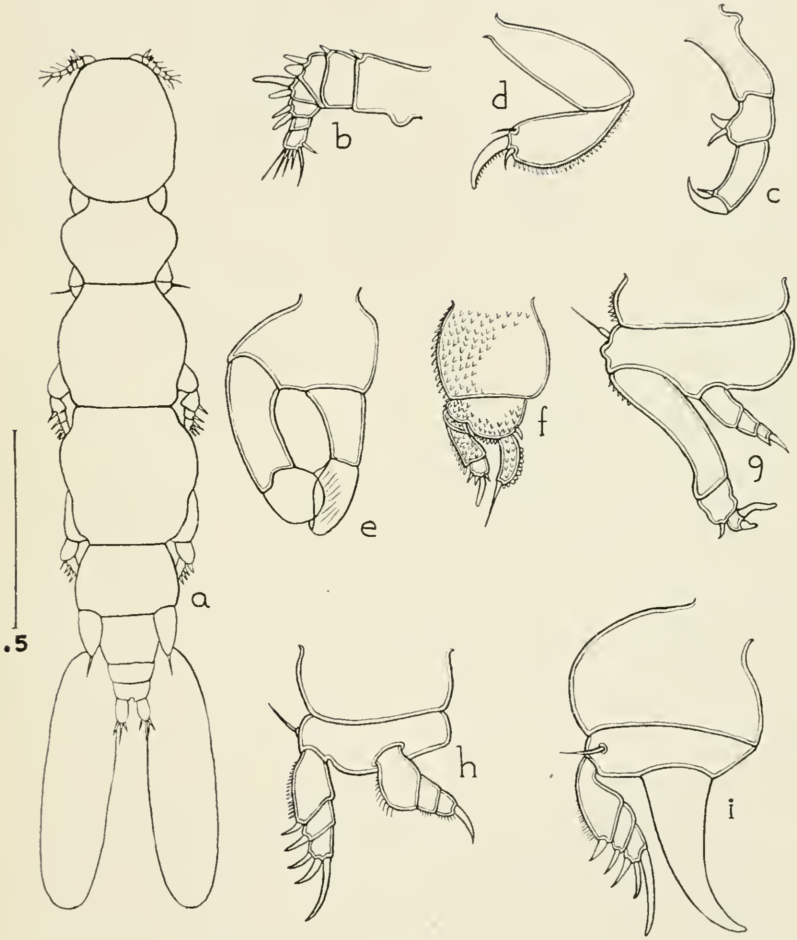
NEMESIS LAMNA

a, Female, dorsal; *b*, male, dorsal; *c*, female, second antenna; *d*, second maxilla; *e*, maxilliped; *f*, *g*, *h*, *i*, first, second, third, and fourth legs; *j*, *k*, *l*, male, first, third, and fourth legs; *m*, male, ventral plate on genital segment.



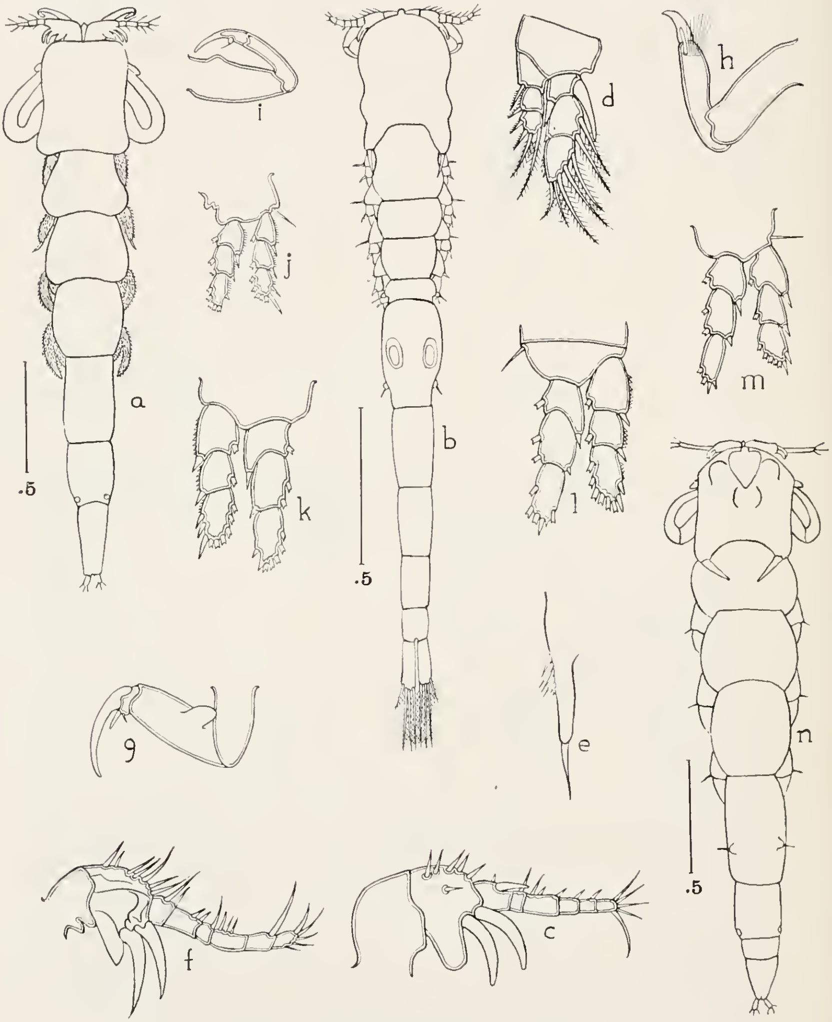
NEMESIS

Nemesis atlantica: *a*, Female, dorsal.
Nemesis pallida: *b*, Female, dorsal; *c*, male, dorsal; *d*, first antenna; *e*, second antenna; *f*, second maxilla; *g*, *h*, *i*, *j*, *k*, first, second, third, fourth, and fifth legs; *l*, second antenna of male; *m*, second maxilla; *n*, maxilliped; *o*, fifth leg; *p*, male, side view of genital segment, showing ventral plate.



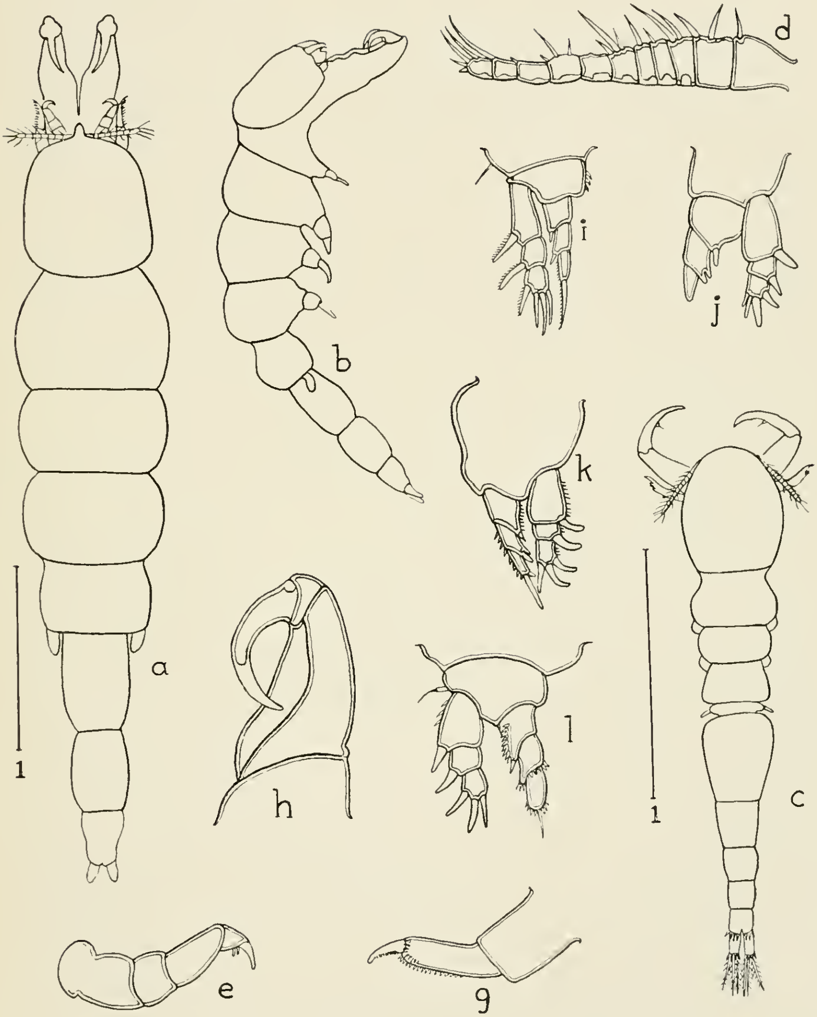
EUDACTYLINA SPINIFERA, NEW SPECIES

a, Female, dorsal; *b*, first antenna; *c*, second antenna; *d*, second maxilla; *e*, maxilliped; *f*, *g*, *h*, *i*, first, second, third, and fourth legs.



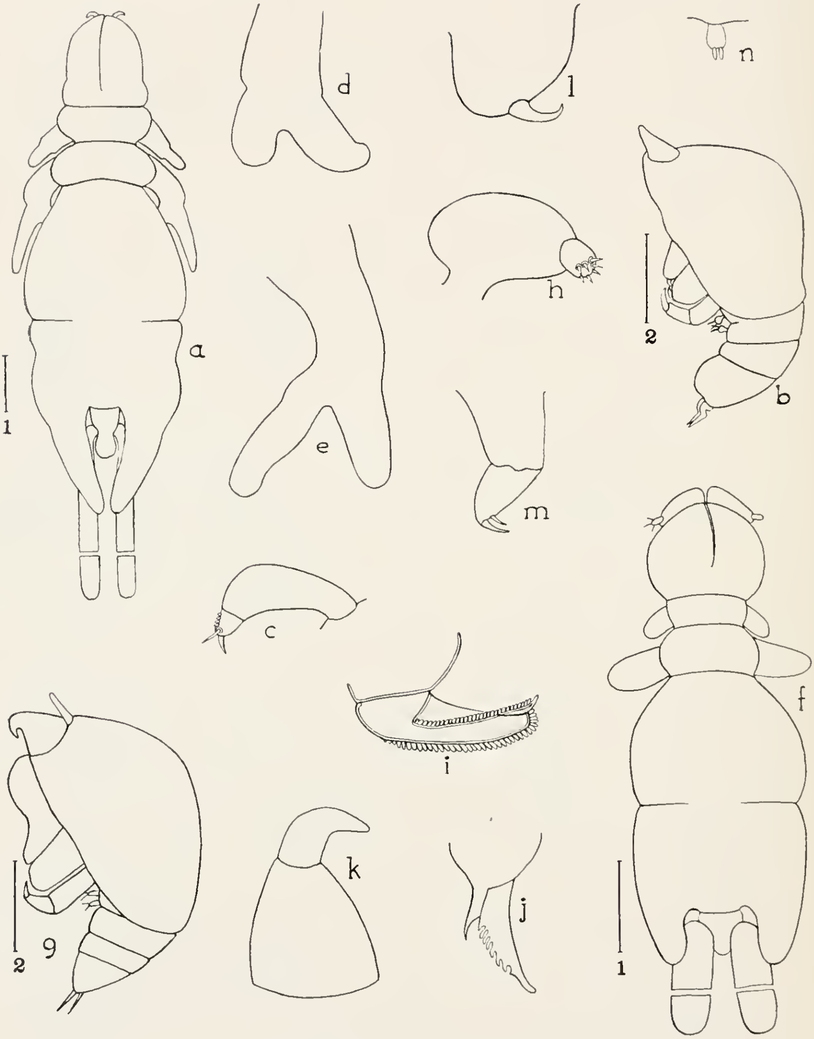
EUDACTYLINODES, NEW GENUS

Eudactylinodes uncinata, new species: *a*, Female, dorsal; *b*, male, dorsal; *c*, female, first antenna; *d*, first leg; *e*, fifth leg; *f*, male, first antenna; *g*, second antenna; *h*, second maxilla; *i*, maxilliped; *j*, *k*, *l*, *m*, first, second, third, and fourth legs.
Eudactylinodes nigra: *n*, Female, dorsal.



EUDACTYLINELLA ALBA, NEW GENUS, NEW SPECIES

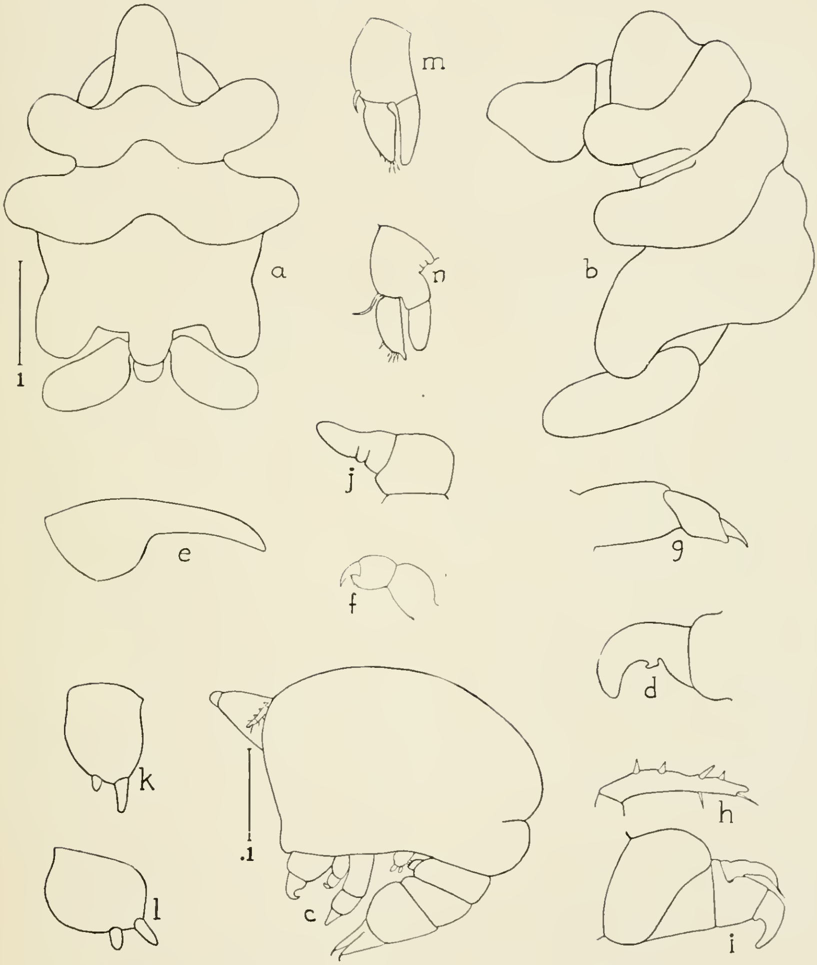
a, Female, dorsal; *b*, female, lateral; *c*, male, dorsal; *d*, female, first antenna; *e*, second antenna; *g*, second maxilla; *h*, maxilliped; *i*, *j*, *k*, *l*, first, second, third, and fourth legs.



ACANTHOCHONDRIA

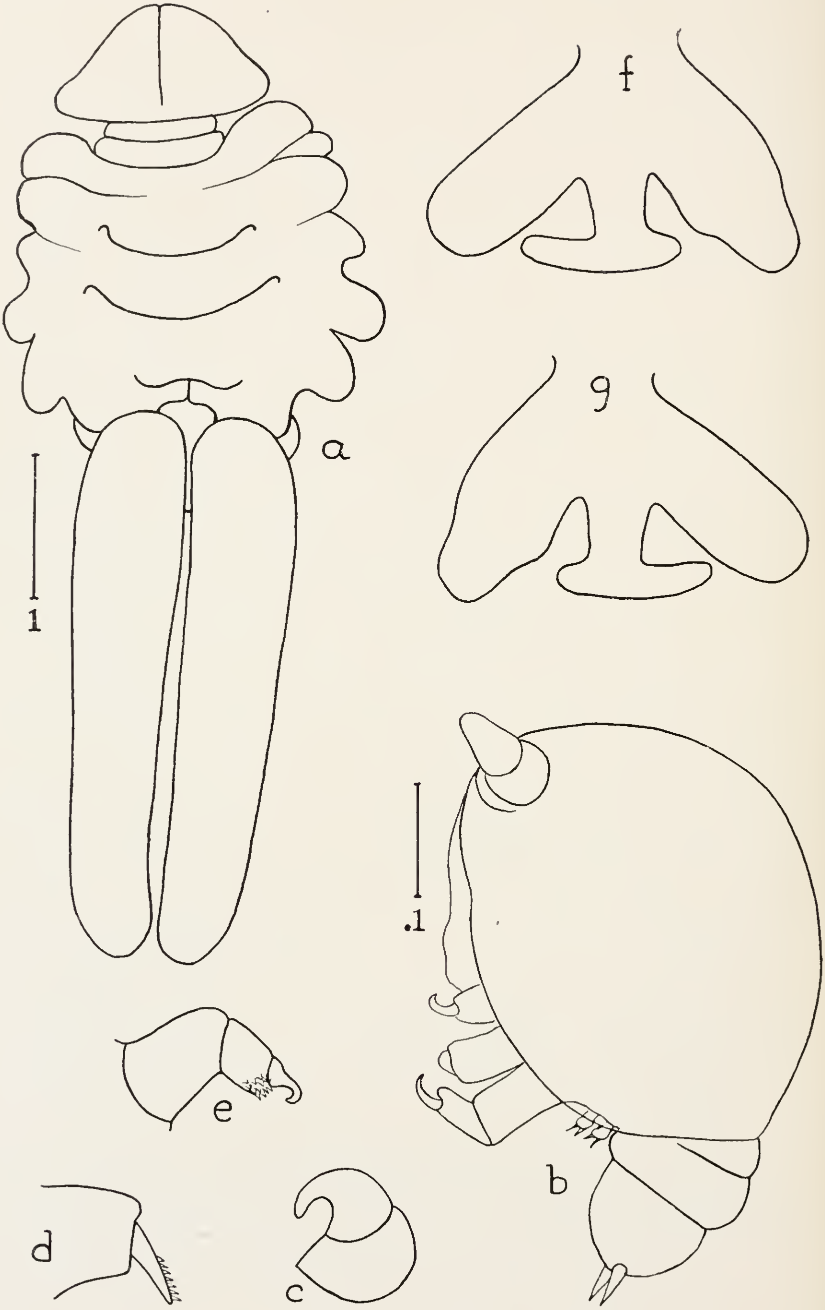
Acanthochondria exilipes, new species: *a*, Female, dorsal; *b*, male, lateral; *c*, female, first antenna; *d*, first leg; *e*, second leg.

Acanthochondria flurae: *f*, Female, dorsal; *g*, male lateral; *h*, female, first antenna; *i*, mandible; *j*, maxilla; *k*, male, second antenna; *l*, second maxilla; *m*, maxilliped; *n*, first leg.



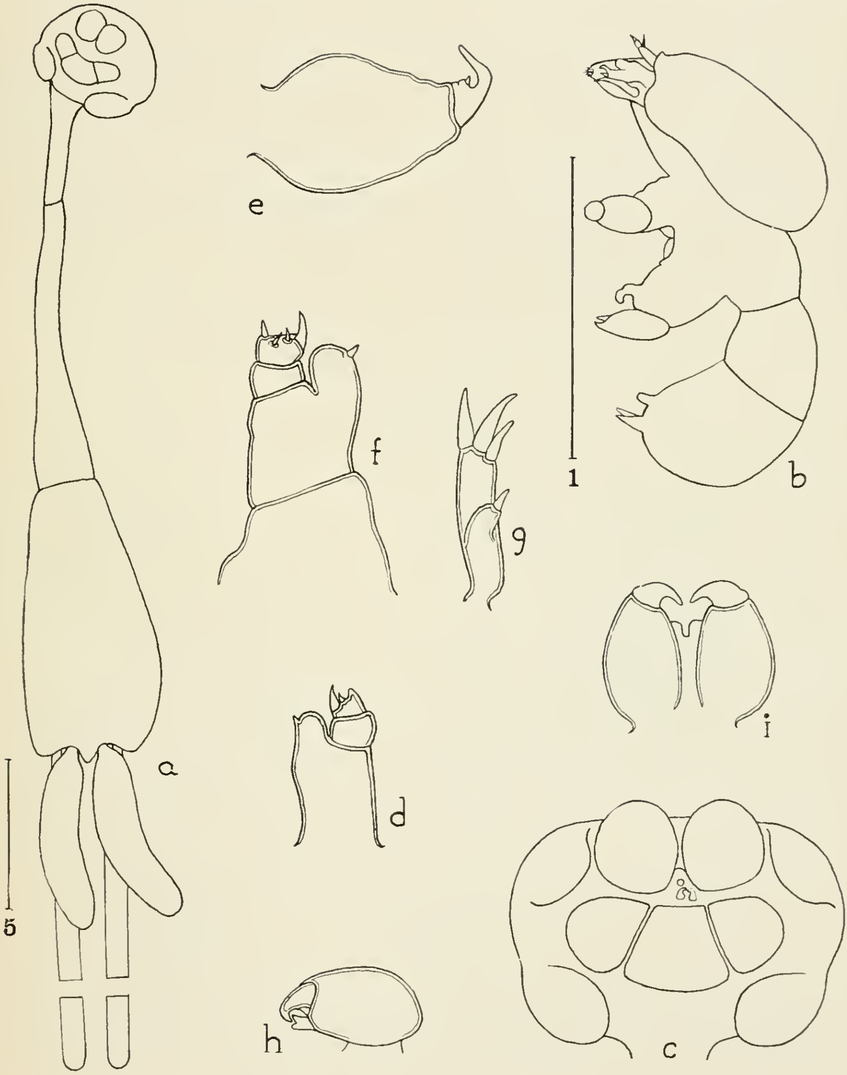
CHONDRACANTHODES DEFLEXUS, NEW GENUS, NEW SPECIES

a, Female, dorsal; *b*, female, lateral; *c*, male, lateral; *d*, female, second antenna; *e*, mandible; *f*, maxilla; *g*, maxilliped; *h*, male, first antenna; *i*, second antenna; j, maxilla; *k*, *l*, female, first and second legs; *m*, *n*, male, first and second legs.



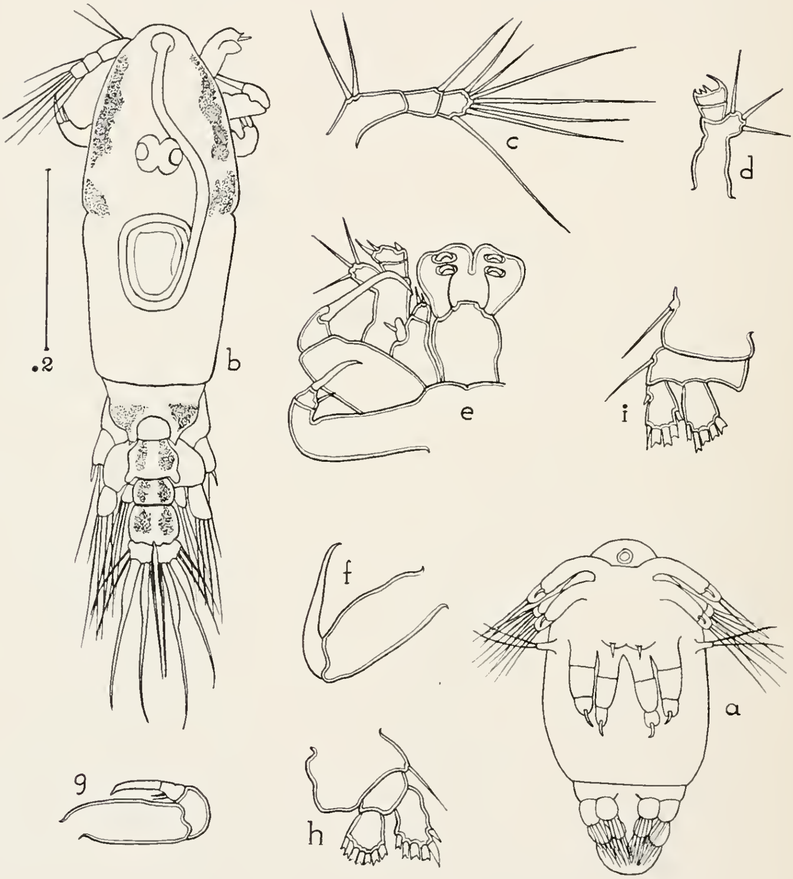
Chondracanthopsis nodosus, New Genus, New Species

a, Female, dorsal; *b*, male, lateral; *c*, female, second antenna; *d*, maxilla; *e*, maxilliped; *f*, first leg; *g*, second leg.



Paeon elongatus, New Species

a, Female, head ventral, trunk dorsal; *b*, male, lateral; *c*, female, head, ventral view enlarged; *d*, second antenna; *e*, maxilliped; *f*, male, second antenna; *g*, first maxilla; *h*, second maxilla; *i*, maxillipeds.



PAEON ELONGATUS, NEW SPECIES: DEVELOPMENT STAGES

a, Newly hatched metanauplius, ventral; *b*, copepodid stage, dorsal; *c*, first antenna; *d*, second antenna; *e*, mouth parts, ventral; *f*, second maxilla; *g*, maxilliped; *h*, first leg; *i*, second leg.

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